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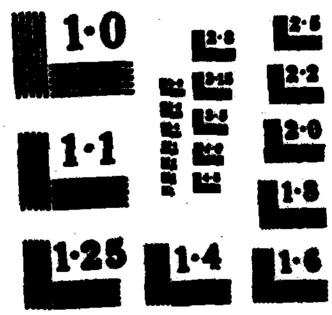
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DCN 84-227-001-01

INSTALLATION RESTORATION PROGRAM

PHASE I: RECORDS SEARCH

REESE AFB, TEXAS

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F08637-83-G0008-5000

June 1984

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EXECUTIVE SUMMARY

A. BACKGROUND

1. Radian Corporation was retained on 22 December 1983 to conduct the Reese Air Force Base (RAFB) Installation Restoration Program Phase I Records Search under Contract No. F08637-83-G0008-5000, with funds provided by the United States Air Force.

This report was prepared to aid in implementing the Air Force Restoration Program at Reese AFB. It is DoD policy

2. DEQPPM 81-5 explains DoD policy, which is to identify and fully evaluate suspected problems associated with past hazardous waste management practices on DoD facilities and to control the migration of hazardous constituents from such facilities that could endanger health and welfare. → (to p x)

3. To implement the DoD policy, a four-phase Installation Restoration Program (IRP) has been directed. Phase I, the records search, is the identification of potential problems. Phase II, if required, (not part of this contract) consists of follow-on field work to determine the extent and magnitude of contaminant migration. Phase III, if required (not part of this contract) consists of technology development (research and development effort only when required). Phase IV, if required (not part of this contract), is the development and implementation of selected remedial actions.

4. The Reese AFB Phase I records search included a detailed review of pertinent installation records; contacts with 6 representatives of local and regional regulatory agencies, and with 2 Texas Tech University faculty members; and an on-site visit conducted by Radian March 12 through 16, 1984. During the base visit, interviews were conducted with 24 past and present installation employees and ground tours of

installation facilities and all identified sites of potential environmental contamination were accomplished. A supplemental search of installation records was conducted to fill data gaps identified during preliminary data review. An additional visit was conducted on April 15, 1984.

(cont fr p. ix)

B. MAJOR FINDINGS include:

(1) Since 1941, many hazardous and potentially hazardous wastes have been generated by industrial shop operations at Reese AFB. Waste oils, solvents, detergents, paint residues, etc., from the flightline shops drain to the storm sewer, flow through an oil/water separator and are ultimately discharged to the Industrial Waste Lake. Although this practice continues to the present day, current waste quantities are significantly lower than in the past. Most wastes are recycled whenever possible, or disposed of off-base through DPDO.

(2) Fire training exercises have provided a means of disposal of waste Avgas, oils and lubricants, and miscellaneous combustible materials since at least the 1950's. The currently active base fire training area has been in use since 1965. Four additional inactive fire training areas were identified at Reese and a small area is presently being used at the Terry County Auxiliary Field.

and (3) Landfills and land spreading areas have been used for waste disposal since the base was constructed. Most of the materials disposed have been construction and domestic wastes, although some hazardous wastes were reportedly landfilled in the past. (to p xi) The only active landfill is located in the southwest corner of the base. It has operated since the mid-1950's and is known to contain small quantities of pesticides and other

hazardous wastes. The landfill was closed to sanitary dumping in 1977.

4. Two active surface impoundments (the Sewage Lake and Industrial Waste Lake) are located on Reese AFB. Both sites are known to contain hazardous wastes. Since 1977, the water in the Sewage Lake has been interconnected with the Industrial Waste Lake via an overflow pump. Water from the Sewage Lake is used for golf course irrigation.

5. Interviews with past and present installation employees results in the identification of 36 past disposal areas, spill sites and fire training areas on Reese AFB that are not documented in written base files.

(cont fr p x)

C. CONCLUSIONS

1. Review of the comprehensive data base assembled for this ~~the Phase I~~ study resulted in identification of 36 sites of potential contamination at Reese AFB,

2. Ten of these 36 preliminary sites were ranked using the Hazard Assessment Rating Methodology (HARM) based on their potential for migration of hazardous constituents.

3. Table 1 presents the 10 HARM-rated sites with their final HARM scores, and their potential risk rating.

D. RECOMMENDATIONS

1. A staged program of Phase II activities is recommended for Site SI-1, the Industrial Waste Lake. Soils should be sampled at a preliminary set of 3 locations, and analyzed for selected metals and volatile halocarbons. If preliminary

TABLE 1. POTENTIAL RISK RANKING BASED ON FINAL HARM SCORES

Site #	Description	Final HARM Score	Potential Risk
SI-1	Industrial Waste Lake	75	High
SI-2	Sewage Lake	68	
D-4	Landfill, north of Sewage Lake	68	
SP-1	Spill, POL Storage Area (Aquasystem)	67	
D-1	Southwest Landfill	60	Moderate
SI-4	CE Paint Shop Trench	56	
FT-1	Active Fire Training Area (Reese)	54	Low
D-5	Landfill, west of Sewage Lake	53	
D-11	Northwest Landfill/Rubble Area	44	

analyses confirm contamination, a second expanded round of soil sampling (4 additional sites) should be undertaken. A ground-water well should be installed and sampled if results from the second round of soil sampling indicate that contaminant migration is extensive and the Ogallala Aquifer is potentially threatened.

2. Soil and soil moisture sampling points should be established at 9 locations around the perimeter of the D-4 landfill site. Samples should be analyzed for EPA 624/625 compounds and metals. If analytical results suggest extensive contaminant migration, a ground-water monitoring well should be constructed and water samples analyzed for selected parameters as determined by results of the soils analyses.

3. A limited Phase II soil sampling program is recommended for Site SI-4, the C.E. Paint Shop trench. Since the exact location of the trench is unknown, 5 or 6 sample borings should be located in a grid pattern over the suspected area to determine whether any contamination persists. Samples should be analyzed by GC/MS for volatile organic compounds (EPA 624). If results are positive, and the trench can be delineated, the gravels lining the trench as well as the underlying materials should be sampled from at least 2 points within the trench itself.

4. A limited Phase II soil sampling program is recommended for the Southwest Landfill (D-1 site). Four soil boring locations should be sampled to a depth of 15 feet. Samples should be collected at 2.5 ft. intervals and analyzed for porosity, permeability, pesticides, selected metals, oil and grease, and volatile halocarbons (EPA 602). Depending on the results of these preliminary analyses, emplacement of a single ground-water well may be advisable near the most highly contaminated soil sampling site to assess potential ground-water contamination.

I. INTRODUCTION

A. Background

The United States Air Force, due to its primary mission, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations which require disposers to identify the locations and contents of disposal sites and to take action to eliminate the hazards in an environmentally responsible manner. The primary federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Sections 6003 and 3012 of the Act, Federal agencies are directed to assist the Environmental Protection Agency (EPA) and state agencies to inventory past disposal sites and make the information available to the requesting agencies. The DOD Installation Restoration Program (IRP), initiated prior to the regulatory requirements, assures compliance with these hazardous waste regulations. The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the IRP. DOD policy is to identify and fully evaluate suspected problems associated with past hazardous contamination, and to control hazards to health and welfare that resulted from these past operations. The IRP will be the basis for response actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as clarified by Executive Order 12316.

There are four phases to the IRP. The records search comprises Phase I. During this phase, installation records are reviewed to identify possible hazardous waste-contaminated sites and to assess the potential for contaminant migration. Only Phase I activities are covered by this contract. Phase II of the IRP consists of follow-on field work to determine the extent

and magnitude of contaminant migration. Phase III consists of technology development (R&D effort only when necessary). Phase IV includes the development and implementation of a remedial action plan.

B. Purpose

The purpose of the Phase I records search is to identify past hazardous materials disposal and spill sites and assess the potential for contaminant migration from these sites. The existence and potential for migration of hazardous material contaminants were evaluated at Reese AFB by reviewing Air Force supplied data, technical reports, and conducting interviews with past and present base personnel, regulatory officials, and local university staff members familiar with Reese. This report addresses the history of operations, the geological and hydrogeological conditions which may contribute to migration of contaminants, and the ecological setting of the facility.

C. Scope

Phase I activities included the following:

- Review site records
- Interview personnel familiar with past generation and disposal activities
- Inventory wastes
- Determine quantities and locations of current and past hazardous waste storage, treatment and disposal
- Define the environmental setting at Reese AFB
- Review past disposal practices and methods
- Gather information from state, local and federal agencies
- Assess potential for contaminant migration, and
- Recommend, if required, follow-on activities.

The pre-performance meeting was held at Reese AFB on January 31 and February 1, 1984. Representatives of the Air Force Engineering and Services Center (AFESC), Reese AFB Civil Engineering, Bioenvironmental Engineering, Base Environmental Protection Committee, and Radian attended the meeting. The purpose of the pre-performance meeting was to provide detailed project instruction. The AFESC Representative provided clarification and technical guidance and defined the responsibilities of all parties participating in the Reese AFB records search.

The onsite installation visit was conducted by Radian from March 12 through March 16, 1984. Activities performed during the onsite visit included a detailed search of installation records, ground tour of Reese AFB and Terry County Auxiliary Field, and interviews with past and present base personnel. The following individuals comprised the Radian records search team:

1. Francis J. Smith, Program Manager, M.S. Sanitary Engineering;
2. Debra L. Richmann, Project Director, M.A. Geological Sciences;
3. James L. Machin, M.S. Environmental Health Engineering;
4. Fred B. Blood, M.S. Biology;
5. Kathey A. Ferland, M.R.P. Regional Planning; and
6. Peter F. Ellis, B.S. Chemistry.

Resumes of team members are included in Appendix A.

The principle Air Force representatives who assisted in the Reese AFB study are:

1. Lt. Col. Joseph C. LaFoy, Base Civil Engineer and AFRCE Representative;
2. Capt. Gene Smith, Installation Point of Contact;
3. Lt. Ray Peters, Base Bioenvironmental Engineer.

D. Methodology

The methodology for the Reese AFB records search is shown graphically in Figure I-1. The first step was a review of past and present industrial operations. This allowed the identification of waste stream contents and quantities. Information was obtained from records such as shop files, hazardous waste disposal permits, and from other state permits.

The second step was to determine past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the industrial operations identified in Step 1. At this stage, sites of former landfills, surface impoundments and tanks were identified. Other potentially contaminated sites, such as the locations of spills of waste oils, solvents or fuels, were determined.

The records search team conducted a ground tour of the base and all land off-base owned by the Air Force. This included the Terry County Auxiliary Field and property acquired by the Air Force in Hurlwood. The team also looked for any evidence of environmental stress, such as disruption of vegetation, or unusual topography, suggestive of potential waste disposal impacts. It was during this onsite visit that interviewing of past and current employees occurred. A list of interviewees and outside agency contacts is presented in Appendix B.

At this point a number of decisions were made. The first decision pertained to the potential for contamination of each site. If it was determined that potential for contamination existed, then the site was evaluated for its potential for migration of hazardous constituents to occur. The site was rated using the Air Force Hazard Assessment Rating Methodology (HARM). This rating system results in a single score for each site which is based on evaluation of factors such as waste type and quantity, receptors, and pathways. This allows the relative ranking of sites with different environmental

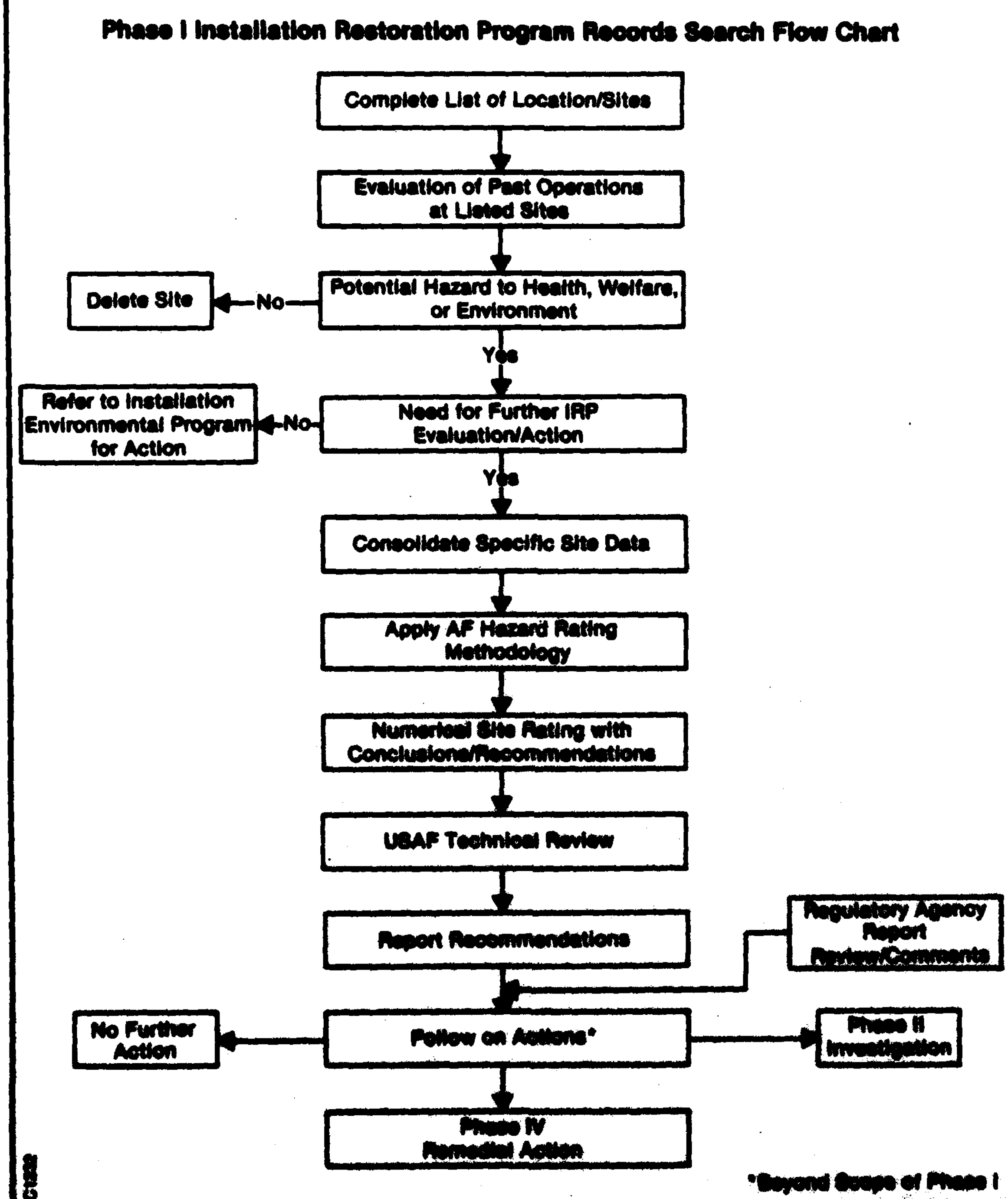

Figure I-1. Installation Restoration Program Phase I Decision Tree. (File data, EAFB)

settings and waste characteristics. Following the hazard rating, recommendations for follow-on activities were made. Recommendations may vary from no action to a complete monitoring and sampling program for those sites receiving a high HARM score. A limited Phase II program may be recommended for sites receiving a moderate HARM rating to confirm that hazardous materials are not migrating from the site. The site rating methodology is described in Appendix C.

II. INSTALLATION DESCRIPTION

A. Location, Size, and Boundaries

Reese Air Force Base is located in the High Plains Region of the Great Plains, ten miles west of Lubbock, Texas. Figure II-1 and II-2 show the regional and area location of the base. The unincorporated community of Hurlwood, population 100, is located just south of the base.

Reese AFB covers 2,777 acres (owned and leased) in Lubbock County, including acreage in the Hurlwood area, acquired in 1978. Figure II-3 shows the layout of the base. Land surrounding the base is primarily agricultural. The majority of the county's industrial, commercial and residential lands are in the City of Lubbock.

Included in the Reese AFB Phase I study is the Terry County auxiliary Field located approximately 36 miles southwest of Reese AFB, and the property owned by the Air Force in Hurlwood. Table II-1 presents the legal status of all acreage associated with the base.

B. Organization and Mission Summary

Reese AFB has been a training base almost continuously since 1941. Reese opened in June 1941 as Lubbock Army Airfield on 2,000 acres donated by the City of Lubbock. The base was completed by the end of 1941 and training of aviation cadets began in early 1942. The field operated during World War II, turning out bomber, fighter and transport pilots. By the end of the war the total of pilots trained exceeded 7,000. The end of the war brought the end of Lubbock Army Airfield in 1945.

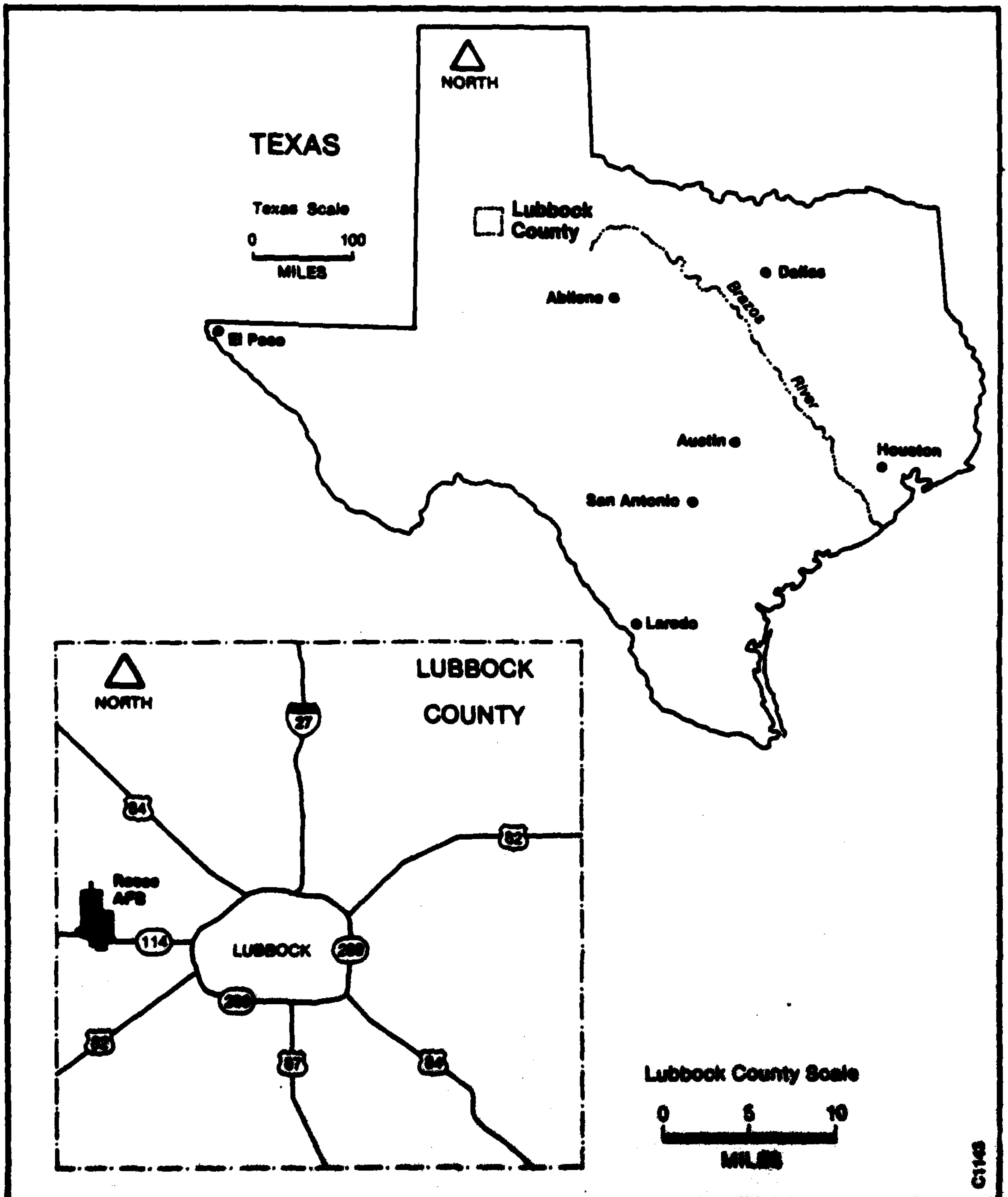

Figure II-1. Regional Setting, Reese AFB, Texas.

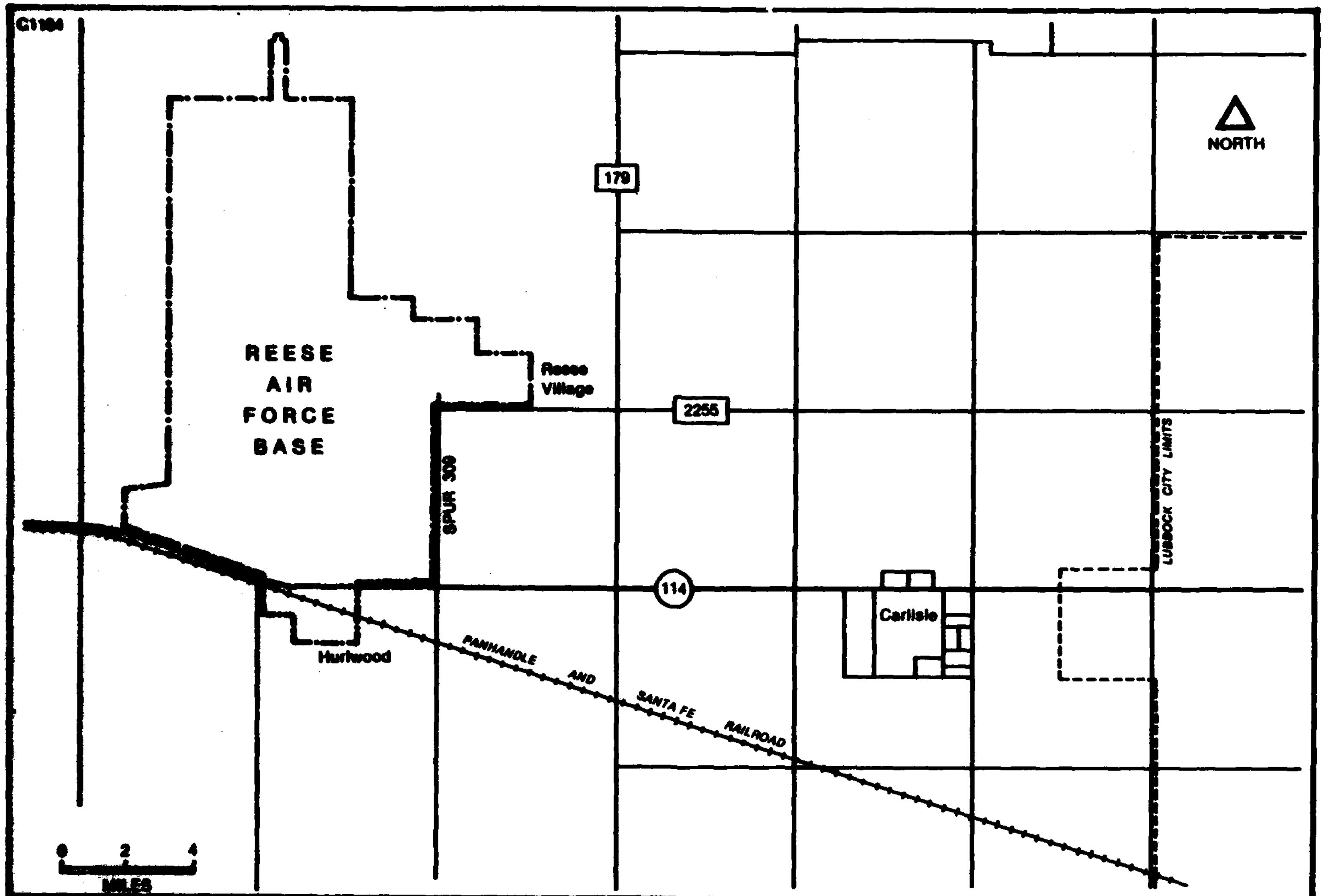

Figure II-2. Reese AFB and Surrounding Area.

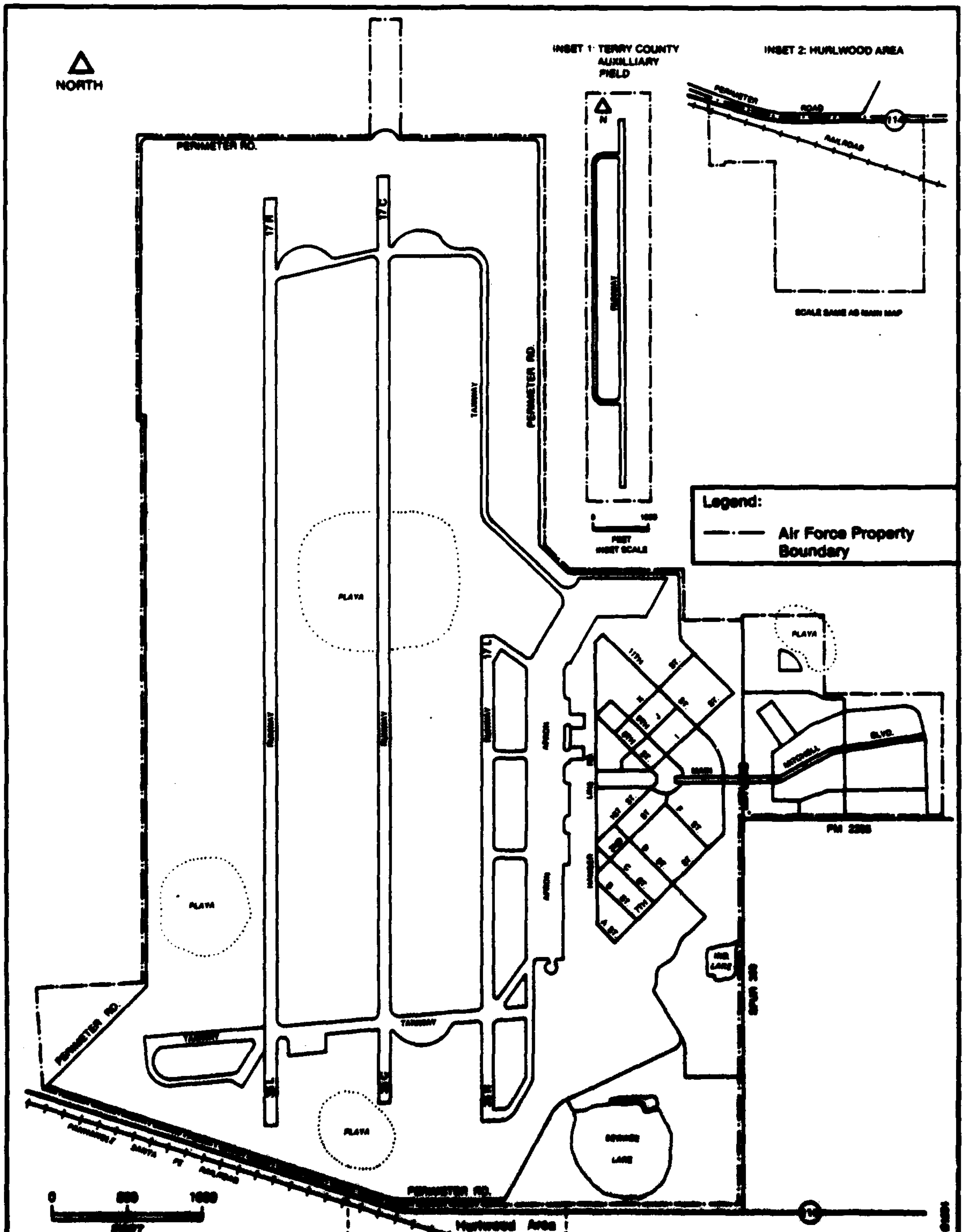

Figure II-3. Generalized Layout of Reese AFB, Texas.

TABLE II-1. LEGAL STATUS OF LAND ASSOCIATED WITH REESE AFB

County	Total Acreage Owned by Reese	Total Acreage Lease/ Easement
Lubbock	2,467	310
Terry	520	0
TOTAL	2,987	310

SOURCE: USAF Real Property Inventory List, Reese AFB, 3 November 1983.

The training center was used from 1945 to 1949 as a housing facility for veterans and their families. It was also used by the National Guard for training missions. In 1949 the 3500th Pilot Training Wing moved to Lubbock from Barksdale AFB, Louisiana and the base was renamed for First Lieutenant Augustus F. Reese, Jr., a native of nearby Shallowater, Texas.

The following types of planes have been previously used in the base training programs including the North American T-6 Texas, the AT-7, and the North American T-28 Trojan. Perhaps the best known craft was the North American TB-25 Billy Mitchell, which was used exclusively from 1955 to 1957. The first jet trainer, the Lockheed T-33 was introduced at Reese in September 1958. Reese's next major advancement was its designation as one of five Undergraduate Pilot Training (UPT) bases in Air Training Command in 1961. This ended the previous system in which preflight, primary and basic flight instruction was conducted at three different bases. The UPT system went supersonic in 1963 when the Northrop T-38 Talon replaced the T-33. The wing was renamed the 64th Flying Training Wing in September 1972. Since 1942, approximately 24,000 pilots have graduated from Reese's training program.

Reese AFB is one of seven Undergraduate Pilot Training (UPT) bases in the Air Training Command. The mission of the UPT bases is to train pilots for the Air Force. The Air Force defines the mission as: "To train top quality military pilots with the greatest efficiency and minimum possible cost." An important secondary mission is the support of the Accelerated Copilot Enrichment (ACE) program. Reese AFB personnel support the training of Strategic Air Command (SAC) copilots assigned to other bases.

Currently, Reese AFB has a force of approximately 1,645 enlisted personnel, 500 permanent party officers and 570 civilians. Generally, about 500 students undergo training at one time, with 400 students graduating annually. The aircraft at Reese AFB includes approximately 80 Cessna T-37 jet engine trainers and 110 Northrop T-38 jet trainers.

The 64th Flying Training Wing (ATC) is the major organization at Reese AFB. The 64th Air Base Group lends administrative and services support. Tenants at the base include:

a) 1958 Communications Squadron (AFSC)

b) Detachment 11, 24th Weather Station

c) Management Engineering Detachment 11

d) OSI Detachment 1113

e) Field Training Detachment 495th OL

f) Defense Property Disposal Office (DPDQ), Satellite of Cannon AFB, New Mexico.

III. ENVIRONMENTAL SETTING

A. Meteorology

The average annual temperature at Reese AFB is 60°F, with extremes of -9° to 108°F. Yearly precipitation averages 16.9 inches, with 80 percent of this occurring from May to October. The maximum rainfall for a 24 hour period was 3 inches. Table III-1 lists temperature, precipitation and snowfall data.

Snowfall occurs in October to March, but the snow normally remains on the ground only a few days at a time. The maximum snowfall in any 24 hour period was 18 inches.

Winds blow regularly in the area, frequently resulting in dust storms. March through October prevailing winds are from the south. During the remainder of the year the wind is predominantly from the west (Figures III-1 through III-4 present wind roses for the area). Mean wind speed is 17 mph.

Tornadoes occur regularly in the Reese AFB area. Reese AFB at the southern end of "Tornado Alley" can expect 3 to 5 tornadoes per year to occur within 30 nautical miles. Hail, 3/4 inch in diameter or greater, can also be expected two to three times per year in the same area. Hailstorms and tornadoes are more likely from April to October.

B. Geology and Soils

1. Soils

Mapping by the Soil Conservation Service has located the following soils series on base: Olton clay loam, Lofton clay loam, Berda loam, Estacado clay loam, Acuff loam, Drake clay loam, Amarillo fine sandy loam, Mansker clay loam, Posey fine sandy loam, Arch loam, and Randall clay. The soils can

TABLE III-1. METEOROLOGICAL DATA

Month	Temperature (°F)					Precipitation (in)				Snowfall (in)		
	Mean			Extreme		Monthly			Max 24 hrs	Monthly		Max 24 hrs
	Daily		Monthly	Max	Min	Mean	Max	Min		Mean	Max	
	Max	Min										
January	53	26	40	81	-9	0.5	2.3	<1	1.2	4	27	17
February	57	30	43	86	-6	0.7	2.2	<1	1.8	4	21	18
March	64	37	51	94	10	0.6	2.5	<1	1.5	1	17	12
April	74	47	61	96	23	2.2	3.0	0.0	1.6	<1	<1	<1
May	82	57	69	102	28	2.7	8.8	0.1	2.4	0	0	0
June	90	65	78	108	46	2.1	5.0	0.2	2.2	0	0	0
July	91	68	80	106	54	2.5	7.9	0.1	2.9	0	0	0
August	89	66	78	102	54	2.0	6.6	<1	2.3	0	0	0
September	82	59	71	100	39	1.7	7.0	<1	2.38	0	0	0
October	74	49	61	93	26	2.1	6.1	0.0	3.0	1	9	6
November	62	37	50	88	1	0.5	1.6	<1	1.2	2	11	8
December	55	29	42	80	3	0.3	1.7	<1	0.8	2	11	6
Annual	73	48	60	108	-9	16.9	8.8	8.8	3.0	16	27	18

Source: USAF, Environmental Technical Applications Center, August 1979.

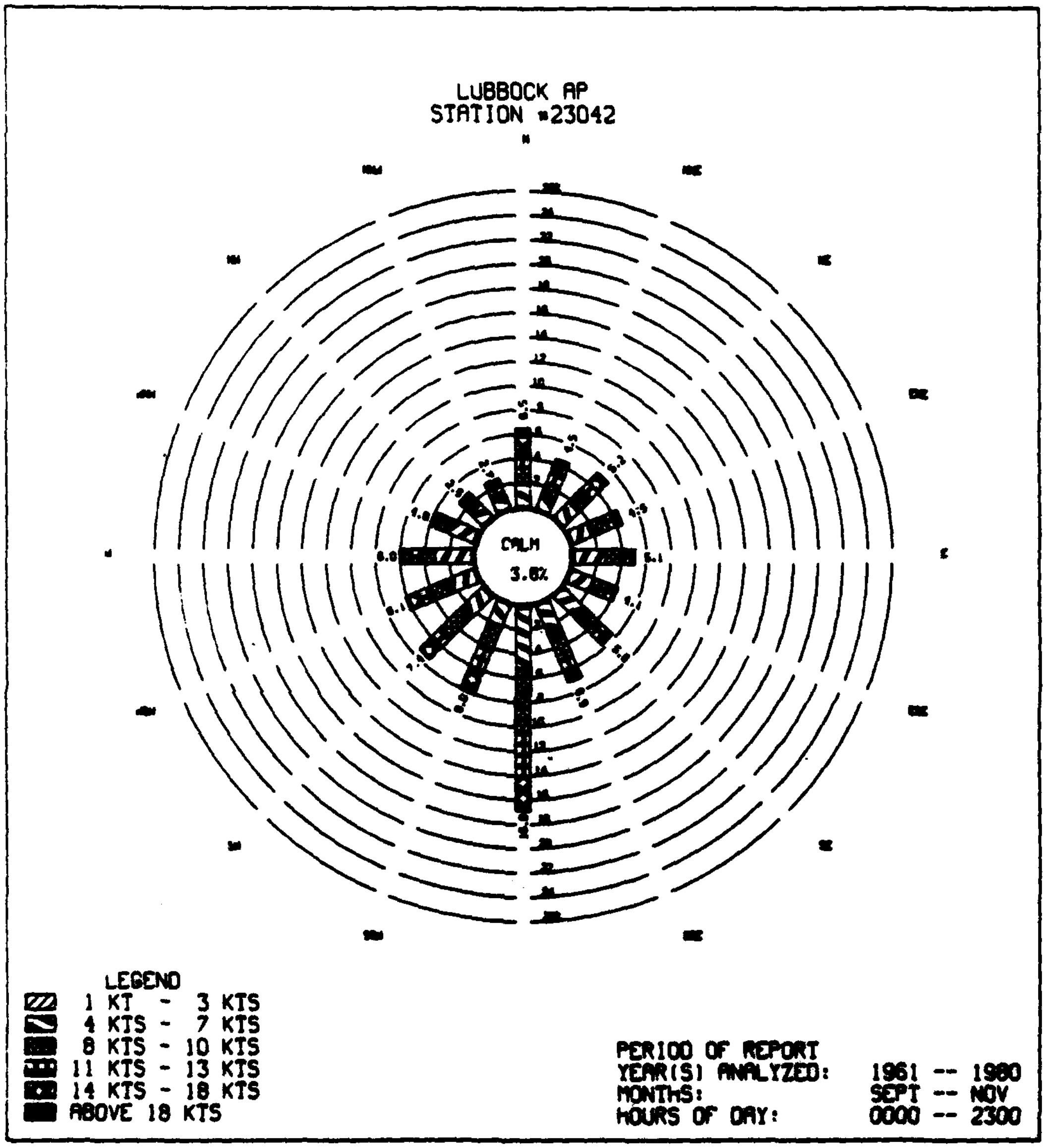

Figure III-1. Wind Rose Diagram (Lubbock Airport).

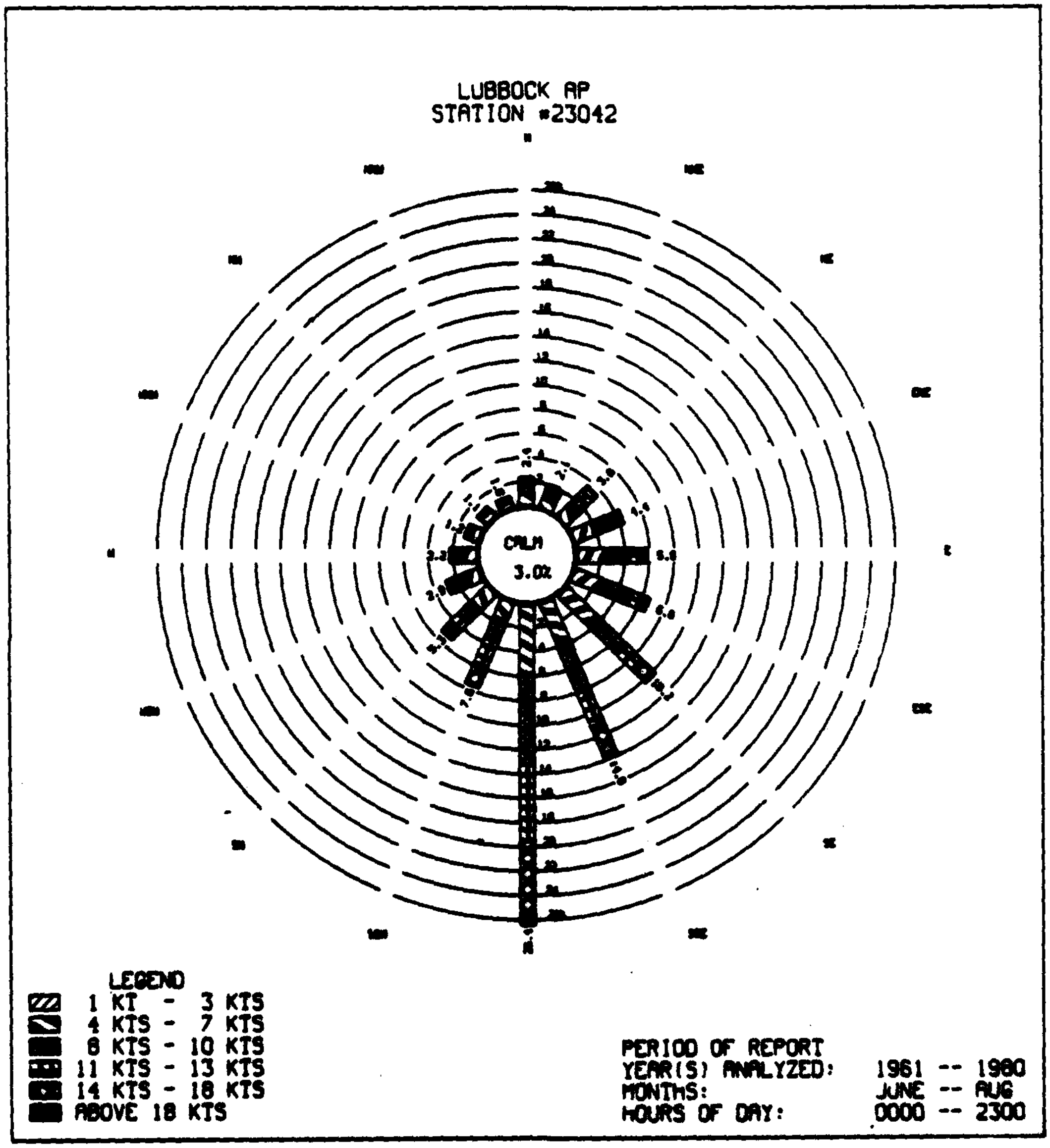

Figure III-2. Summer Wind Rose Diagram (Lubbock Airport).

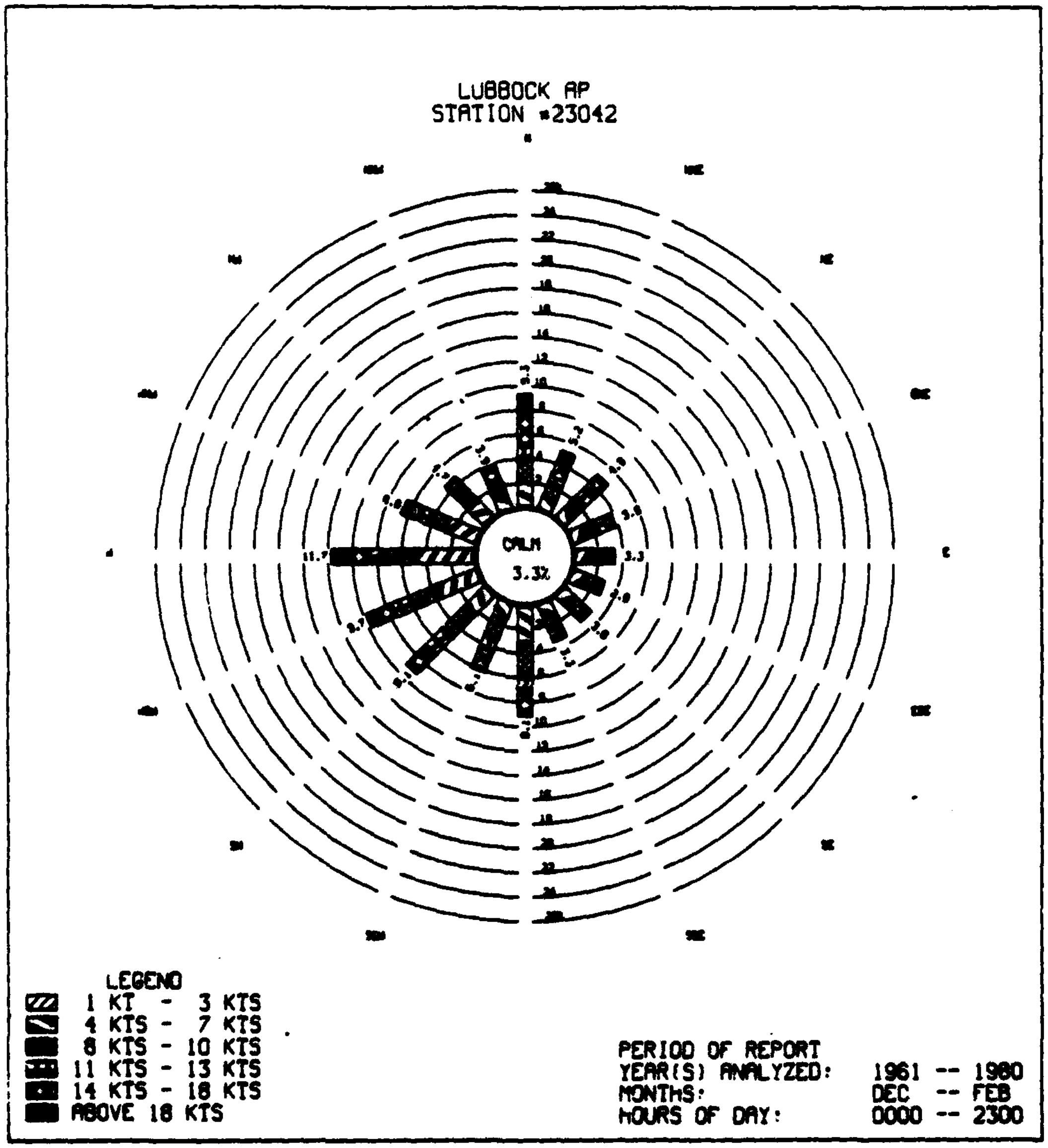

Figure III-3. Winter Wind Rose Diagram (Lubbock Airport).

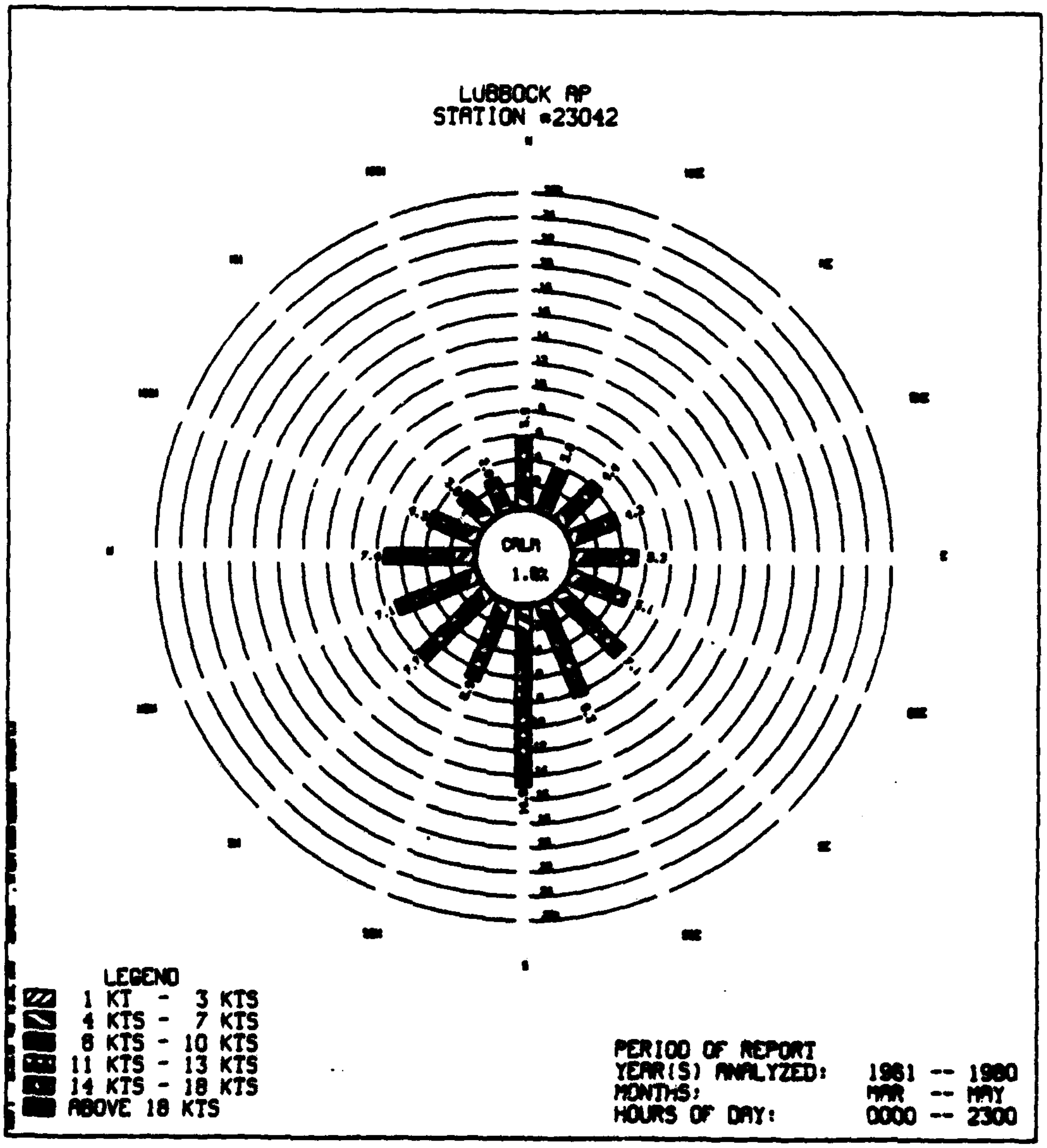

Figure III-4. Spring Wind Rose Diagram (Lubbock Airport).

be grouped into three categories: clay, sandy loam and clay loam. Figure III-5 shows the locations of each soils series and Table III-2 lists the soil types, permeabilities and thicknesses for each series.

The prevalent soil of the base is Acuff, a sandy clay loam. This soil is well-drained, with moderate permeability of 4.2×10^{-4} to 1.4×10^{-3} cm/sec, (in/hr). Soils near or under the Industrial Lake playas and the drainage areas near the central runway are Randall clay, a poorly-drained soil with very slow permeability, on the order of 4.2×10^{-5} cm/sec. The most permeable soils on the base are the Amarillo series. Amarillo soils have a permeability of 1.4×10^{-3} cm/sec to 4.2×10^{-3} cm/sec. They are found as the original soil at the site of the Southwest Landfill and approximately 200 feet (61m) from the Industrial Lake.

2. Geography and Topography

Reese AFB is located in Lubbock County in the southern Panhandle of Texas, also known as the Southern High Plains Region. This region occupies an area of about 22,000 square miles in northwest Texas, extending from the Canadian River southward about 250 miles and from the New Mexico line eastward about 120 miles. The eastern boundary of this region is the Caprock Escarpment, which is characterized by deep channels formed by intermittent streams. In general, topography is flat; the land surface generally slopes about 2 percent to the southeast. However, slopes may increase to 8 percent around saline lakes, draws, and intermittent lakes called playas.

Lubbock city is 3,338 feet above sea level. The elevation at Reese AFB id 3338 feet above sea level, with only a 25 foot change in elevation throughout the base area. Most of the base land has a 0 to 1 percent slope. Only near the playas and lakes are slopes of 1 to 3 percent encountered.

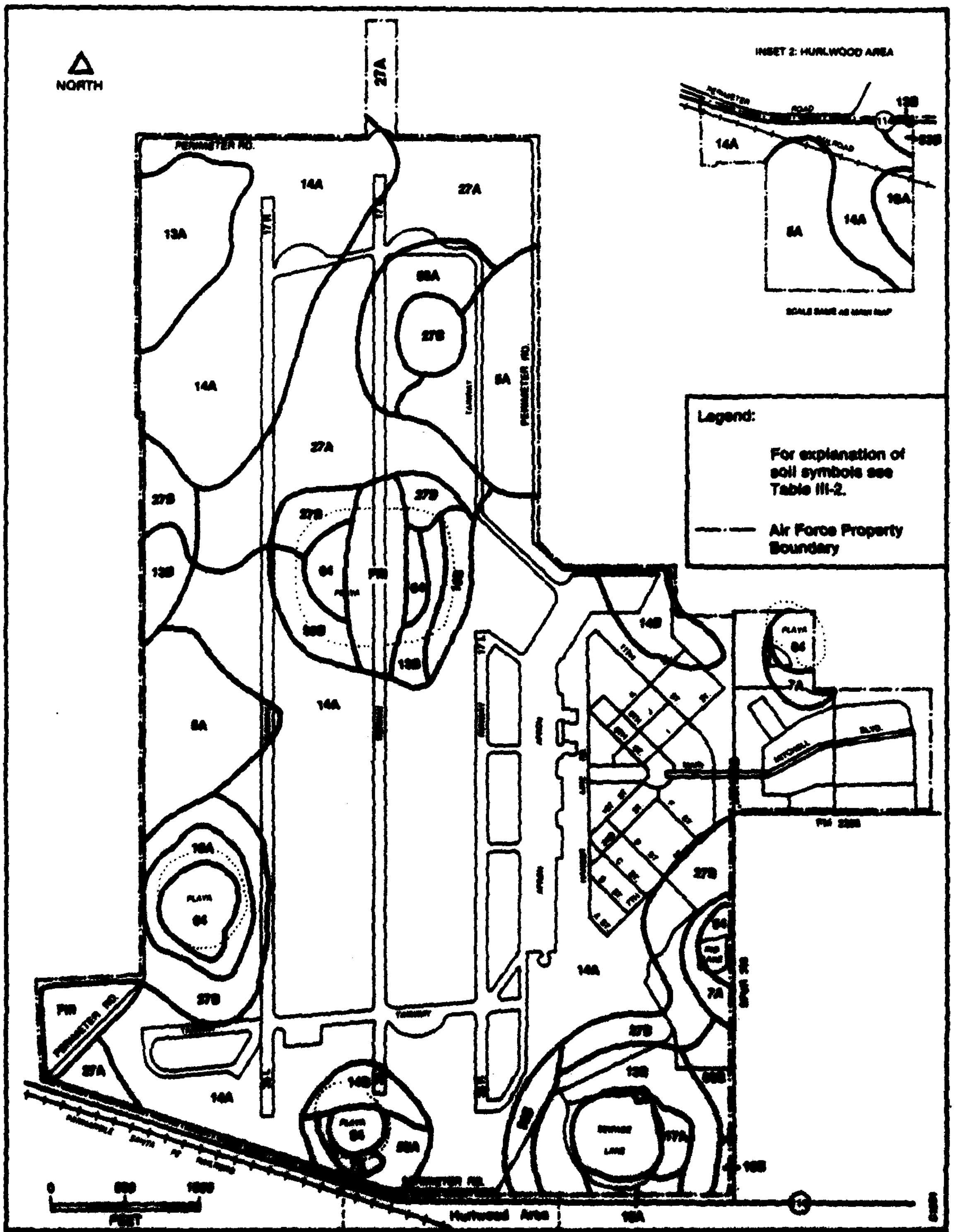

Figure III-5. Soils Map, Reese AFB, Texas (File data, RAFB).

TABLE III-2. CHARACTERISTICS OF SOIL SERIES OCCURRING AT REESE AFB

Soils/ Symbol*	Lofton 7	Estacado 13	Acuff 14	Amarillo 27	Mansker 53	Randall 64	Olton 5	Posey 56	Arch 17	Drake 16	Berda 10
Thickness	~80 in.	80 in.	80 in.	80 in.	~66 in.	66 in.	80 in.	80 in.	~60 in.	~80 in.	72 in.
Constituents	Fine, mixed, clay loam cracks on drying	Fine loamy, mixed. $CaCO_3$: 10-50%	Fine loamy, sandy clay loam. $CaCO_3$: 20-60%	Fine loamy, clay loam or sandy clay loam. @ 3', calcium carbonate.	Fine loamy, up to 65% $CaCO_3$, 20-35% clay,	40-60% clay; underlain by caliche in playas.	Fine, mixed clay to clay loam, $CaCO_3$ @ <60" up to 45% clay.	Fine, sandy loam, up to 35% clay.	Fine loamy, mixed; lime @ 10-20"; $CaCO_3$; does not contain some clay.	Fine, loamy mixed $CaCO_3$ includes clay, 20-35%	Loam.
Setting	Benches around playas.	Nearly level to gently sloping.	Gentle slopes, less than 5%.	Slopes 0.5 to 5%.	Nearly level to sloping. Slopes 0-8%.	Playas, 3'-50' below plain.		0-12% slopes.	Level to gently sloping.	Eastern edges of playas 1-10% slope.	1-3% slope.
Drainage	Moderately well drained, slow runoff or ponding.	Well drained, surface runoff slight.	Well drained, runoff slow to medium.	Well drained; slow to medium runoff.	Well drained, medium to rapid runoff.	Poorly drained; internal drainage slow; when dry, water enters rapidly and stands until evaporated.	Well drained, runoff slow to very slow.	Well drained, medium surface runoff.		Well drained, rapid runoff.	Well drained.
Permeability (in/hr)	Very slow permeability	0.6-2	0.6-2	2-6 top 11" of soil. 0.6-2 11"-80" of soil	Moderate permeability	0.6	0.10-0.20	2-6 top 10" of soil. 0.6-2 10"-80" of soil.	N/A	0.6-2	Moderate permeability

SOURCE: U.S. Department of Agriculture, Soil Conservation Service, National Cooperative Soil Survey, Fort Worth, Texas, 1972.

*Slope designation: A = 0-1%
B = 1-3%
C = 3-5%

3. Drainage

Shallow, undrained depressions or playas are characteristic of the plains surface. During periods of heavy rainfall, runoff collects in the depressions to form temporary ponds or lakes. Playas are generally circular with interior drainage toward the center. The majority are 50-100m in diameter and are less than 1m in depth. Water percolating through windblown deposits probably initiated playa formation, and the basins were then deepened by wind erosion. Stream drainage of the plain surface is poorly defined as runoff occurs over the eastern escarpment during periods of short-duration, high-intensity thunderstorms.

There are no natural, permanent surface water bodies on the base. Storm runoff is routed into culverts and transported under runways and roads, or is allowed to follow the topography. Storm runoff collects in six areas on-base. Three of these collection areas form playas, the intermittent lakes common to the region. Two of the runoff collection sites are part of the base waste disposal system, and thus, are wet year round. Drainage features are depicted in Figure III-6.

Generally, water moves away from the center of the base into playas located near the perimeter or drains off-base to the north. Precipitation is collected in the center of the base by storm culverts, which route water away from runways. Water from these central culverts collects in two ditches, both part of a former playa, near the Primary Instrument Runway.

4. Regional Geologic Setting

Geologic units ranging in age from Pliocene to Recent crop out in the study area and throughout much of the Southern High Plains of Texas. In the vicinity of Reese AFB, the Pliocene-age Ogallala Formation is the dominant surface unit. Caliche deposits within the Ogallala Formation underlie much of the surface of the Southern High Plains of Texas. The caliche consists of resistant beds, lenses, and nodules of calcareous and siliceous

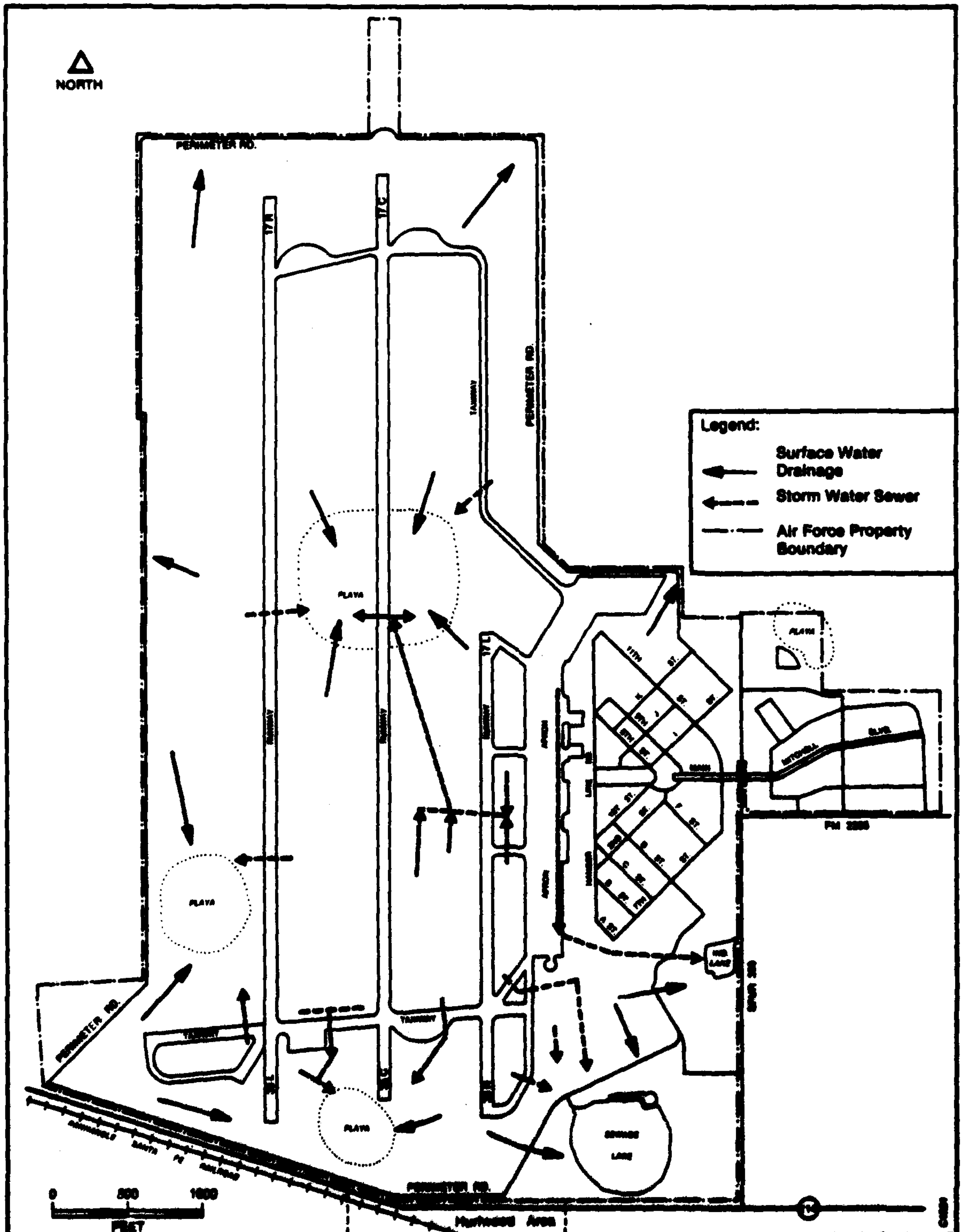

Figure III-6. Natural and Man-Made Drainage Pathways, Reese AFB, Texas (File data, RAFB, 1959).

material. The caliche forms the conspicuous caprock of the eastern plains escarpment.

Cretaceous rocks are present only in the subsurface at Reese AFB, forming an erosional contact with the Ogallala. They are, however, exposed along the eastern escarpment which passes through the southeastern part of Lubbock County. Thin deposits of Pleistocene and Recent age sediments overlie the Ogallala Formation in many places. These consist of lake or pond (playa) deposits, stream deposits, and sand-dune deposits. These sediments are important hydrologically where they occur in recharge areas such as in sand-dune areas or alluvial drainageways. The lake or pond deposits consist chiefly of clay and silt and, therefore, downward percolation and subsequent recharge is impeded. Characteristics of the regionally significant stratigraphic units in the Southern High Plains of Texas are presented in Table III-3.

Major regional structures include the Matador Arch and Palo Duro Basin north of the study area, and the Midland Basin to the south. Figure III-7 illustrates the distribution of these and other major geologic features, as well as the outcrop distribution of major lithostratigraphic units. A generalized geologic cross-section of the Southern High Plains is included as Figure III-8.

5. Local Geologic Setting

The Ogallala Formation is the dominant geologic unit exposed in the study area. The formation consists of multiple lithologic units including sands, silts, clays and limestones that are laterally discontinuous over the base.

Lithologic logs available from 8 base wells that tap the Ogallala aquifer section indicate that a caliche zone, varying from approximately 20 to greater than 40 feet in thickness, immediately underlies the surface soils (Figure III-9). In many places throughout the High Plains, the caliche is

TABLE III-3. STRATIGRAPHIC UNITS AND THEIR WATER-BEARING PROPERTIES, SOUTHERN HIGH PLAINS OF TEXAS

System	Series	Formation or group	Thickness (feet)	Lithologic description	Water supply
Quaternary	Recent		0- 15	Chiefly windblown sand and silt.	Yields no water to wells. Sandy areas form excellent recharge facilities.
	Pleistocene		0- 144	Sand, clay, diatomaceous earth, volcanic ash, limestone.	Mostly above water table. Does not yield large supplies.
Tertiary	Pliocene	Ogallala formation	0- 500	Fine to coarse sand and gravel; clay, silt, and caliche.	Yields large supplies of water throughout the Southern High Plains.
Cretaceous	Comanche	Washita, Fredericksburg, and Trinity groups	0- 200+	Fine to coarse sandstone and conglomerate; limestone, blue and yellow shale or clay.	Locally important as source of small supplies of water; should not be considered as a major source of water for the Southern High Plains in general.
Triassic		Dockum group Tecovas formation Santa Rosa sandstone Chinle formation equivalent	150-1,800+	Varicolored shale and sandy shale, gray or brown cross-bedded sandstone and conglomerate.	Probably capable of yielding small to moderate supplies of water; most of the water is at least slightly saline.
Permian			8,000±	Soft red sandstone, shale, and clay, beds of gypsum and dolomite.	Not known to yield water to wells; water is probably saline.

Source: Texas Board of Water Engineers, 1961 (Bull. 6107)

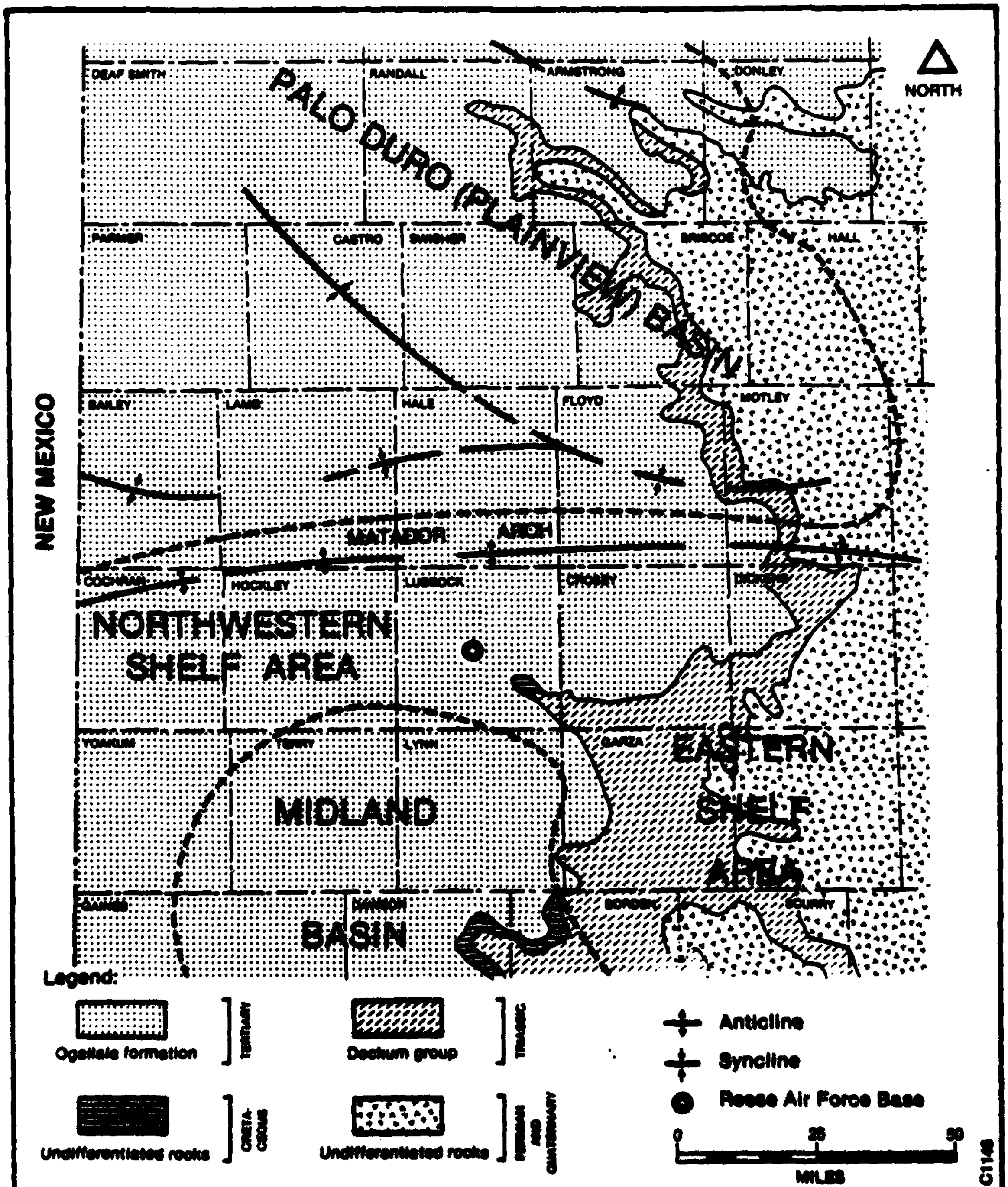

Figure III-7. Regional Geologic Setting, Reese AFB, Texas (Modified from Cronin, 1961).

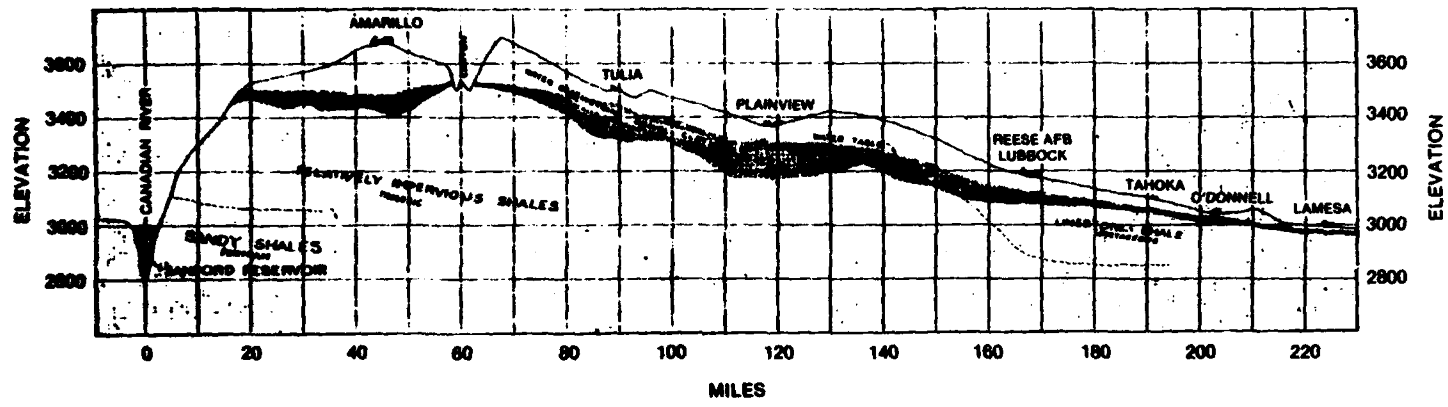

Figure III-8. Generalized Geologic Cross-Section of the Southern High Plains Region of Texas (File data, RAFB).

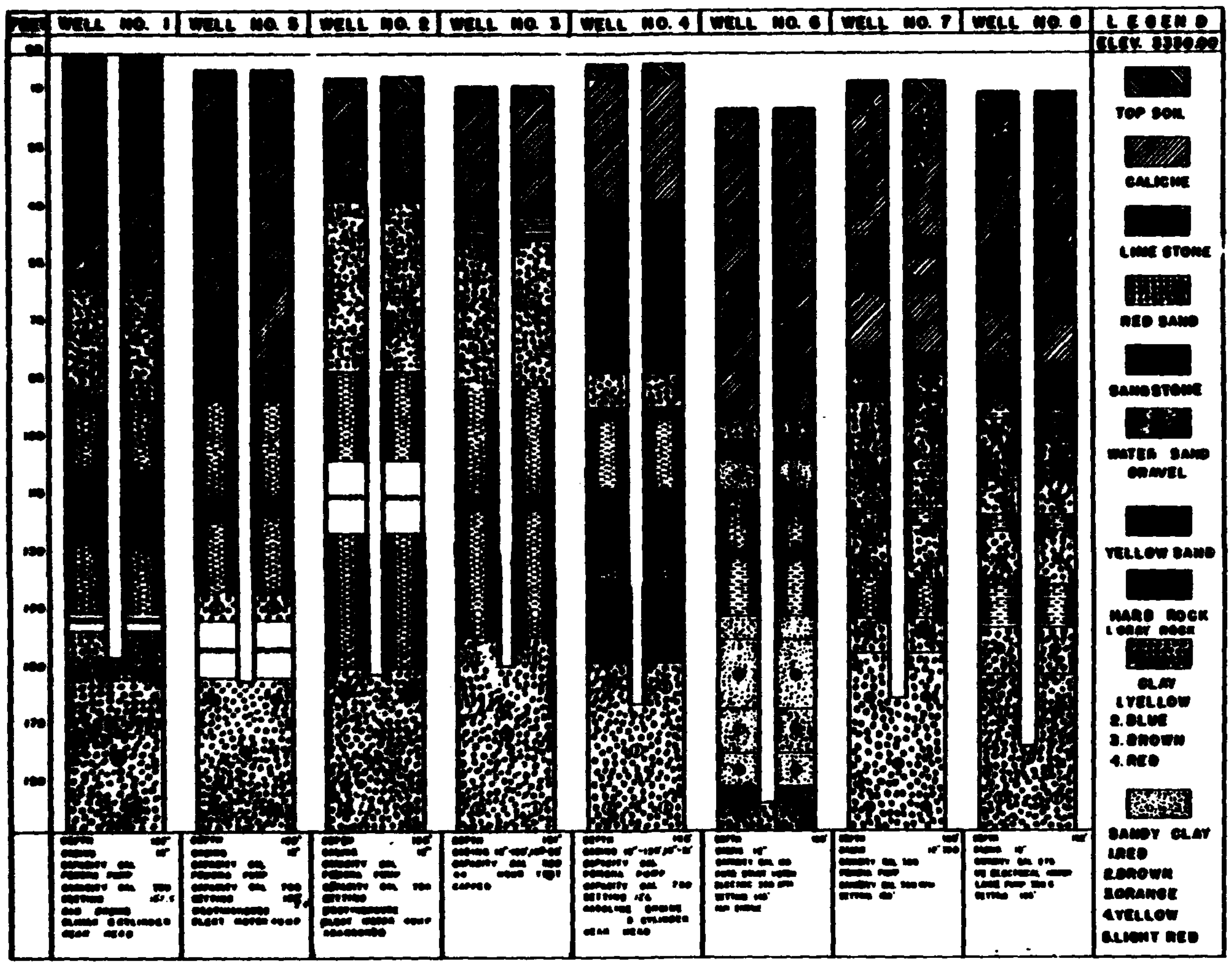

Figure III-9. Lithologic Logs of Reese AFB Ground-Water Supply Wells Nos. 1-8 (File data, RAFB).

almost completely indurated and is an impediment to recharge. However, in some areas the caliche is porous and may not significantly hinder downward percolation from the surface. The completely indurated caliche, (caprock) which is generally believed to underlie the base, is a massive, very durable rock in undisturbed sections. The porosity of the hardened caliche varies from 25 to 40 percent, however, the permeability of this caprock caliche is very low. The presence of this thick, relatively impermeable zone impedes downward percolation of water and therefore severely limits the amount of recharge to the aquifer, even in areas where the surface soils may be locally permeable.

Six playas, or seasonal lakes, were originally present within the boundaries of Reese AFB. One playa, underlying the midsection of the central runway, was filled during runway construction. Two of the other playas have been modified to serve as a sewage lagoon and industrial waste pond. Playa bottoms are generally composed of silts and clays. These clays and silts exhibit extremely low permeabilities, thereby restricting downward percolation of surface waters into the substrate.

C. Hydrology

The Pliocene Ogallala Formation is the principal aquifer in the Southern High Plains of Texas, supplying practically all the water used for all purposes. The formation is continuous throughout most of the Texas portion of the Southern High Plains. Sediments of Recent Age (younger) generally lie above the water table, and therefore, do not yield water. However, these deposits do serve as catchment areas for precipitation and thus aid in the recharge of the Ogallala Formation. This is especially true of the sandhills areas because the porosity of the sand is such that precipitation is readily absorbed, resulting in little, or no runoff, thus making the sandhills area an exceptionally favorable zone of recharge to the groundwater reservoir.

Regionally, the Ogallala Formation is thicker in the northern part of the area, and ranges in thickness from a maximum of approximately 500 feet thick to a "knife's edge" where the formation pinches out against outcrops of older rocks. Erosion has completely isolated the formation so that the segment in the Southern High Plains is cut off in all directions from any underground connection with water-bearing beds outside of the area, excetp through the underlying older rocks which contain highly mineralized water distinct from the fresh water in the Ogallala. This emphasizes the fact that the source of all the water in the Ogallala is precipitation that falls on the surface of plains in Texas and New Mexico.

Generally, the water in the Ogallala occurs under water table conditions; however, locally, because of its lithologic variability, it may be under slight artesian pressure. The water in the Ogallala occupies the pore spaces and voids in the rocks and occurs between the water table and the underlying older rocks. The thickness of the zone of saturation in the Ogallala varies throughout the Southern High Plains chiefly because of the uneven nature of the bedrock surface. This thickness ranges from 0 to more than 300 feet. In the vicinity of Reese AFB, the saturated thickness is approximately 30 feet (Smith, 1981).

Depth-to-water below land surface measurements are made annually in approximately 120 wells in Lubbock County (Smith, 1981). Results indicate a local trend of anually declining water levels in the county consistent with the regional trend. The total drop in water levels for all observation wells measured in 1970 and again in 1980 was 6.19 feet. This results in a ten year average water level drop of 0.62 foot per year. The wells in the county which were measured in January 1980 and again in January 1981 showed an average decline of 1.86 feet (ibid). Elevations of the water table in the Ogallala across Lubbock County are shown on Figure III-10. The depth to water in the vicinity of Reese is approximately 150 feet.

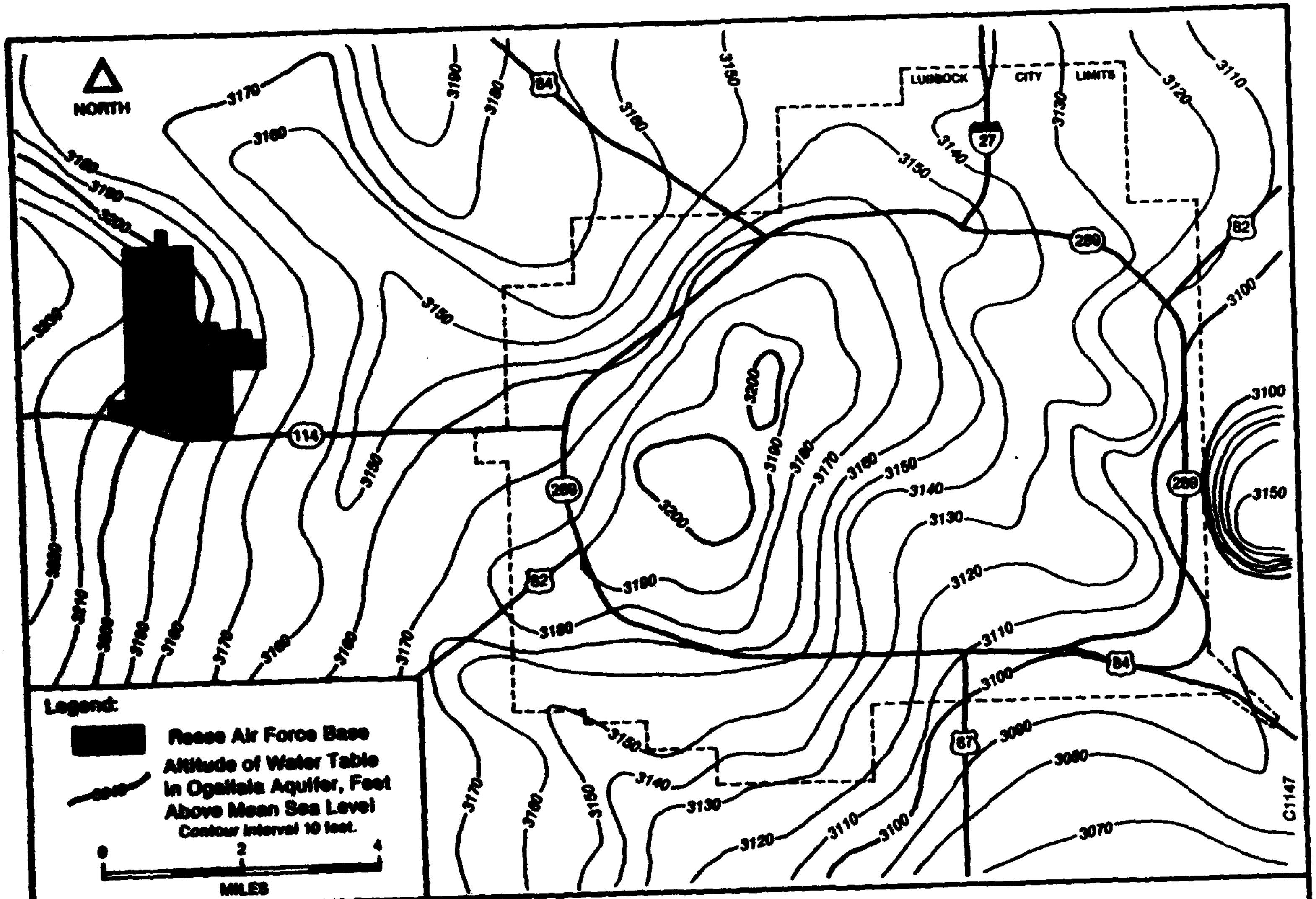

Figure III-10. Water Table Configuration of the Ogallala Aquifer in the Vicinity of Reese AFB, Texas (Modified from Cronin, 1961).

Natural recharge to the Ogallala aquifer is believed to be less than one inch annually. The principal source of recharge is infiltration from precipitation. A small portion of the water used for irrigation may percolate downward to the aquifer; however, this does not constitute an additional supply of water but only a reduction in net discharge.

During interviews with base personnel, the existence of a shallow perched ground-water zone in the area of Reese AFB came into question. This shallow zone of saturation was purported to contain water suitable for stock watering and irrigation at depths of 50-70 feet, recoverable by windmills. It was termed the "Windmill Aquifer".

If such shallow ground-water zones do exist on Reese AFB, they could significantly influence the migration of potential ground-water contaminants from base sources. To confirm the existence or absence of such a zone, Radian conducted a review of available literature and telephone interviews with local ground-water resource authorities.

The literature review provided no evidence of a perched zone above the water table of the Ogallala Aquifer in the area of Reese AFB. The only reference to a shallow water bearing zone was found in a report by Leggat (1952). He indicated that in a small area in northern Lynn County (south of Lubbock County), a group of shallow wells, 60 to 90 feet deep, draw water from honeycombed silicified caliche. The thickness of the caliche ranges from 23 to 71 feet. Conversations with personnel of the High Plains Water Conservation District (HPWCD) do not support the existence of a perched zone constituting an aquifer at Reese AFB. Mr. Wayne Wyatt, director of the HPWCD, stated that thin lenticular perched zones are regionally encountered at shallow depths above laterally discontinuous layers of low-permeability materials. He said that he knew of no present or historical evidence of such a zone in the area of Reese AFB. He speculated that if such a zone existed below the installation, it would probably be insignificant as a water-producing zone. He supported this conclusion by referencing the small amount of downward

percolation available as recharge, as described in the literature. It was his opinion that significant accumulations of downward percolating waters (as perched zones) would probably not occur. This is prevented by the discontinuous nature of low-permeability materials in the area above which perched water could accumulate and the numerous wells in the area which facilitate drainage.

1. Ground-water Quality

The regional quality of water from the Ogallala Aquifer is described in the literature. Cronin (1961) divides the Ogallala into two distinct water-quality regions. These regions are defined by areas of the Ogallala which are underlain by Cretaceous and Triassic units. The type of materials which comprise the lower surface of the Ogallala (Cretaceous vs. Triassic sediments) plays a major role in determining the chemistry of its water.

Cretaceous rocks comprise the lower surface of the Ogallala in the area of Reese AFB. Principal chemical constituents of ground-water obtained from the aquifer include bicarbonate, calcium and magnesium. Sodium, chloride and sulfate ions are also found as major constituents in some areas. Total dissolved solids for the Ogallala is generally found at levels at 300 mg/L but below 1000 mg/L (Muller, 1979).

Water obtained from the Ogallala in the region of Reese AFB is generally suitable for drinking, irrigation and most industrial usages. Locally, some of the major parameters listed above may be naturally present at undesirable, yet acceptable levels. High levels of silica and "hardness" in many areas may render the waters of the Ogallala unsuitable for industrial applications without pre-treatment (Cronin, 1961). Elevated levels of fluoride and nitrate are also found in portions of the aquifer. With the exception of nitrate, levels of the aforementioned parameters can be principally attributed to natural sources.

Fluoride occurs at elevated concentrations in the Ogallala in the area of Reese AFB and throughout the High Plains. These levels of fluoride are reported to cause staining of the tooth enamel, especially in children who ingest the water on a regular basis. Water quality analyses for the base production wells reveal the presence of fluoride at levels as high as 10 mg/L.

Analyses of water from production wells are provided in Appendix D (USAF, 1984). The data reveal that most parameters were found at acceptable concentrations. Analysis for metallic species include arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver. With the exception of chromium, the metals were present at levels at or below detection limits. Chromium was found in samples collected from base production well No. 9 on December 2, 1980 and January 24, 1984 at levels exceeding drinking water standards. The source of chromium in ground-water from this well has not been determined, but it apparently represents an isolated occurrence. Although total chromium was measured at 132 µg/L, hexavalent chromium was <50 µg/L (1984 data). Analysis for major ionic species and general water quality parameters for the base production wells are consistent with regional findings.

Bromodichloromethane, dibromochloromethane and bromoform were found at concentrations of 0.22, 1.1 and 3.2 ug/L, respectively, in a sample collected from the Base Water Plant in 1981. The presence of these industrial organic species in the treatment water which is received from the base production wells may indicate that organic contaminants from base sources have entered the aquifer. However, these compounds are used in fire extinguishers throughout the base and are used extensively in fire training exercises. It is possible that the levels detected resulted from sample contamination during collection. Additional sampling should be conducted to determine the source with certainty.

2. Local Ground-water Use

Thirteen ground-water supply wells (12 on-base and 1 at the Terry County Auxiliary Field) tap the Ogallala aquifer. However, at present, only 3 are active and these supply only minor volumes of water. The locations of all ground-water supply wells are illustrated on Figure III-11.

During the on-site visit, an open well casing, sheared off at ground level, was discovered on the property in Hurlwood, acquired by Reese AFB. Additional unknown abandoned wells are suspected in this area and should be inventoried for proper closure.

Presently, more than 98 percent of the base's potable water requirements are supplied by the City of Lubbock. A large part of Reese AFB's water originates from the Sand Hills Field in Baily County and is transported to Reese AFB via city-owned pipeline. Additional potable water may come from the Canadian River which is also treated and supplied by the City of Lubbock.

In the community surrounding Reese AFB, private wells which tap the Ogallala are used to supply drinking water and for irrigation. Fluoride, selenium, and nitrate are commonly present at elevated levels but these levels are generally attributed to natural sources.

D. Surface Water Quality and Hydrology

Reese AFB is located within the Brazos River Basin. The Brazos River drains approximately 45,000 square miles in Texas and New Mexico. Drainage is toward the southeast to the mouth of the river near Freeport, Texas.

Approximately 9600 square miles of the basin is considered non-contributing drainage area. This includes all of Reese AFB. Very little surface drainage in this area ever reaches the Brazos River since almost all runoff is collected in playas. The only stream near Reese AFB is over ten miles from the base and is intermittent. This is the North Fork of the Double Mountain Fork of the Brazos River (known as Yellowhouse Draw) which runs through Lubbock.

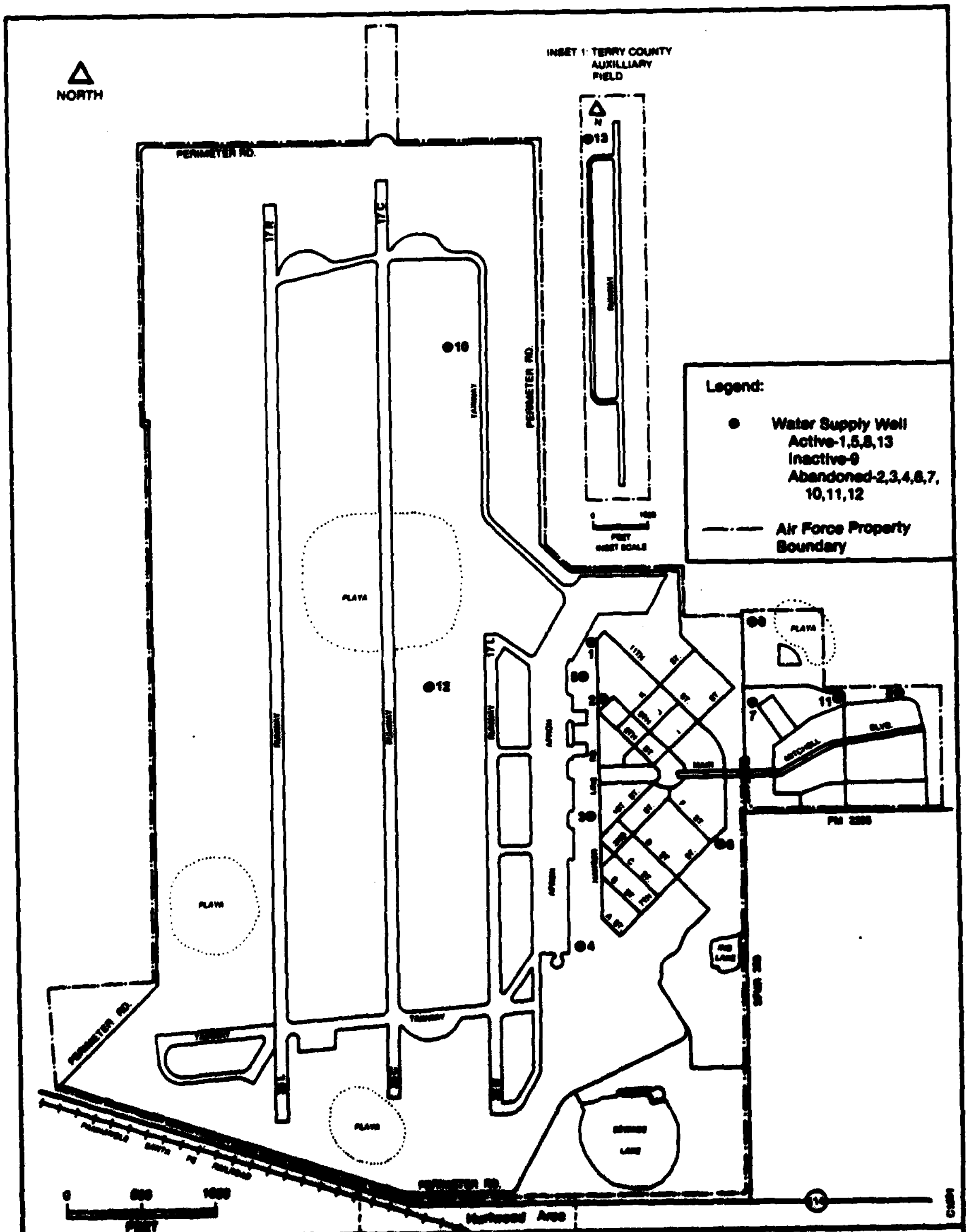

Figure III-11. Ground-Water Supply Wells, Reese AFB, Lubbock and Terry Counties, Texas.

Of the playas collecting surface runoff at Reese AFB, only two are considered significant. The first is referred to as the Sewage Lake located in the southeast corner of the base. This playa receives the base sewage plant effluent which, in turn, is used to irrigate a golf course. The second playa is about one-half mile northeast of the Sewage Lake and receives storm runoff and industrial wastewater effluent from the oil/water separator. Water is occasionally pumped from the Industrial Waste Lake to the Sewage Lake to prevent flooding during wet weather.

Water and sediment samples from the Reese playas have been analyzed by the USAF OEHL. Additional analyses have been performed by the Texas Department of Health. Representative analyses are included in Appendix D.

Water samples from the Sewage Lake have indicated water quality typical of a domestic sewage lagoon. There are elevated concentrations of ammonia and other nitrogen forms, phosphates, dissolved solids, and occasionally iron. Other trace metals have been detected only in very low concentrations.

Samples from the Industrial Waste Lake have revealed slightly elevated levels of phosphates, sulfates, and iron. Other metals including lead and manganese were detected occasionally. Samples taken at the lake inlet were analyzed by the Texas Department of Health for volatile organic compounds. They were found to contain moderate levels of methyl ethyl ketone (MEK), methylene chloride, and tetrachloroethylene (TCE). However, in mid-lake samples, only tetrachloroethylene was detected. A possible explanation is that during residence in the lake, these compounds are volatilized to the atmosphere.

Sludge and bottom sediment samples from the Industrial Waste Lake have contained elevated levels (on the order of 100 ppm) of a number of trace metals, including zinc, chromium, lead, copper, and cadmium. Also, low levels of unsaturated hydrocarbons were detected. However, E.P. Toxicity tests on these samples yielded comparatively low concentrations of metals.

The above results indicate that the metals in the Industrial Waste Lake sludge are relatively immobile. This is confirmed in that insignificant concentrations have been measured in the lake water.

One research report indicated that polynuclear aromatic hydrocarbons (PAH's) were detected in the sediments of the Sewage Lake (Sweazy, et al., 1977). Perylene was measured at a concentration of 300 ppb. Other PAH's were detected in trace amounts less than 6 ppb. Perylene is a PAH of low biological significance. Other PAH's have been shown to be carcinogens. It was suggested that the use of old asphaltic concrete as riprap in the Sewage Lake may have been the source of the PAH's (Sweazy, et al., 1977). The measurement of perylene at a concentration two to three orders of magnitude greater than other PAH's, some of which are isomers of perylene, makes these data suspect. Private communication with one of the authors of the above report revealed some problems with the PAH analyses during the research. Although they believed perylene to be abnormally high, there was some question about laboratory error with the levels reported (Rose, 1981).

E. Environmentally Sensitive Conditions

Reese AFB is in the short-grass prairie of the Southern High Plains. This habitat is characterized by essentially flat topography, high evaporation rates and low rainfall. Small seasonal playa lakes fill during the "wet" season, generally during late summer. Before farming and irrigation lowered the depth to the water table and altered evaporation-runoff patterns, these playas were important habitat for migrating waterfowl.

The present environment is man-dominated. Very few playas retain water and extensive agricultural practices have disrupted natural wildlife, in particular, prairie dogs. Although the sewage playa retains water year round and attracts waterfowl, it is not considered an unaltered or pristine natural area. Also, the habitat at Reese AFB does not attract threatened or endangered species.

IV. FINDINGS

Past hazardous waste management practices at Reese AFB were identified and evaluated for their potential to cause environmental contamination and/or to pose a threat to human health. This section provides a summary of typical wastes and estimated quantities generated by activity, a description of past and current disposal practices used at Reese AFB, and a site-specific evaluation of all disposal sites identified.

A. Past Activity Review

To identify past activities on the base that generated hazardous wastes, ultimately requiring disposal, a review of current and past waste generation and disposal methods was conducted. This review included interviews with current and former (both civilan and military) base employees, a search of files and records (maintained by Reese AFB and outside agencies), and site inspections.

Potentially hazardous wastes generated by Reese AFB can be associated with one of four groups of activities conducted on base:

a. Industrial Operations (Shops);
b. Fuels Management (POL);
c. Pesticide Utilization; and
d. Base Hospital and Laboratory Operations.

The following discussion addresses only those wastes generated on base which are either hazardous wastes or potentially hazardous wastes. A hazardous waste is defined as hazardous by the regulations implementing either the Resource Conservation and Recovery Act (RCRA) or the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). Compounds such as polychlorinated biphenols (PCB) which are listed in the Toxic Substances Control Act (TSCA) are also considered hazardous. Other substances

such as oil spills which affect the health of the environment are also considered hazardous wastes or potentially hazardous wastes. A potentially hazardous waste is one which is suspected of being hazardous, even in cases where insufficient data are available to fully characterize the waste.

1. Wastes Generated by Activity

a. Industrial Operations (Shops)

Several industrial shops at Reese AFB generate potentially hazardous wastes as a result of mission support activities. Bioenvironmental Engineering Services provided file information which was used as a basis for evaluating past waste generation and hazardous material disposal practices. The files were examined for information on chemical usage, hazardous waste generation, and disposal practices.

For the shops which handled hazardous materials or generated hazardous waste, key personnel within the Reese maintenance support functions were interviewed. During the interviews, information was gathered concerning hazardous materials utilized, waste quantities generated and disposal practices for each shop. Where possible, a timeline of disposal methods was established for the major wastes generated. In most cases, timeline information could only be estimated. A summary of information obtained during the shop review is presented in Table IV-1. This table presents a list of building locations as well as the hazardous materials, quantities used, and disposal method timeline. Much of the disposal method information is based on information derived from interviews with personnel. Confirmation of some of the past disposal methods within the shops was difficult because written information was essentially nonexistent and remembered incidents were often not confirmed due to the elapsed time since occurrence. The information on waste quantities shown in Table IV-1 is based on verbal estimates given by shop personnel at the time of the interviews, as well as information derived through the record searches from the files. Areas of Reese which do

TABLE IV-1. INDUSTRIAL OPERATIONS (SHOPS), ASSOCIATED WASTES AND DISPOSAL METHODS, REESE AFB

Shop Name	Location (bldg. no.)	Waste Material	Waste Quantity	Method(s) of Treatment, Storage & Disposal: 1940	1950	1960	1970	1980
64th Field Maintenance Squadron (FMS)								
Jet Engine Test Cell	40	Jet Fuel (JP-4)	400 gal/yr			Reused on-base, FTP	Disposed off-base, DPDO Recycled off-base, gen.	Reused on-base, FTP
		Synthetic Oil	550 gal/yr			Reused on-base, FTP	Disposed off-base, DPDO Recycled off-base, gen.	Recycled off-base, DPDO
Aerospace Ground Equipment (AGE) Maintenance	50	Synthetic Oil	250 gal/yr			Reused on-base, FTP	Disposed off-base, DPDO Recycled off-base, gen.	Recycled off-base, DPDO
		Hydraulic Fluid	300 gal/yr					
		Motor Oil	400 gal/yr					
		Solvent (PD-680)	100 gal/yr					
		Soap Compound	600 gal/yr					
Accessory Repair Shop	52	Carbon Remover	60 gal/yr		Reused on-base		Disposed off-base, DPDO Recycled off-base, gen.	Recycled off-base, DPDO
		Corrosion Preventive	60 gal/yr					
		Lube Oil	60 gal/yr					
		Solvent (PD-680)	300 gal/yr					
		Finger Print Neutralizer	60 gal/yr					
Pneudraulics Shop	52	Hydraulic Fluid	500 gal/yr				Disposed off-base, DPDO Recycled off-base, gen.	Recycled off-base, DPDO
		Solvent (PD-680)	100 gal/yr					
Aircraft Battery Shop, Electric Shop	52	Battery Acid	15 gal/yr					Storm drain, oil sep., and Industrial Lake
		NI+CD-contaminated Potassium hydroxide	30 gal/yr					
		NI+CD batteries	250/yr					Disposed off-base, DPDO
		Lead acid batteries	15 gal/yr					
		Solvent (PD-680)	30 gal/yr			Reused on-base, FTP	Disposed off-base, DPDO Recycled off-base, gen.	Recycled off-base, DPDO
Jet Engine Shop	52	Synthetic Oil	500 gal/yr			Reused on-base, FTP	Disposed off-base, DPDO Recycled off-base, gen.	Recycled off-base, DPDO
		Hydraulic Fluid	100 gal/yr					
		Solvent (PD-680)	600 gal/yr					
Wheel & Tire Shop	52	Trichloroethane Drums	2/yr					Disposed Off-base, DPDO
		Solvent (PD-680)	600 gal/yr			Reused on-base, FTP	Disposed off-base, DPDO Recycled off-base, gen.	Recycled off-base, DPDO

NOTE:
Confirmed dates are denoted by solid lines (——)
Assumed dates are denoted by dashed lines (- - -)

TABLE IV-1. (Continued)

Shop Name	Location (bldg. no.)	Waste Material	Waste Quantity	Method(s) of Treatment, Storage & Disposal: 1940	1950	1960	1970	1980
64th Field Maintenance Squadron (FMS) (Continued)								
Chemical Cleaning Plant	53	Paint Removed (butyl-cell-osolve)	"Drag off"	Burned, FTP	Drummed, DPDO			Storm drain, oil sep., & Indus. Lake
		Carbon Remover (ferrous alkali) (Sodium Hydroxide)	Drippings					Stormdrain, oil sep., and Indus. Lake
		Descaler	"					
		Phosphoric Acid	"					
		Paint Stripped (benzyl alcohol+)	400 gal/yr	Burned		To Industrial Lake	Drummed, DPDO	Recycled off-base, DPDO
		Potassium Permanganate	"Drag off"					Stormdrain, oil sep., and Indus. Lake
Corrosion Control	59	Methyl Ethyl Ketone/ Acetone	30 gal/yr		Disposal, DPDO		Recycled off-base, gen.	Disposed off-base, DPDO
		Lacquer Thinner (Xylene, Toluene, MIBK)	100 gal/yr				Recycled off-base, gen.	Disposed off-base, DPDO
		Various lacquers, pigments, etc.	Overspray		Drummed, DPDO			Stormdrain, oil sep., and Indus. Lake
		Pickling Solution (Alodine)	"Dragout" Drippings		Drummed, DPDO			Stormdrain, oil sep., and Indus. Lake
Metal Processing Shop	59	Chromic Acid	60 gal/yr			Industrial Lake	Recycle off-base, DPDO	
		Potassium Permanganate, Sulfuric Acid, Hydrochloric Acid	"Dragoff" 5 gal/yr			Stormdrain, oil sep., and Industrial Lake		
		Cadmium Oxide Sol'n.		Industrial Lake		Disposed off-base, DPDO		
		Sodium Cyanide Sol'n.		Industrial Lake		Disposed off-base, DPDO		
		Pickling Acid (Alodine)			Industrial Lake		Recycle off-base, DPDO	
		Plating Sludge			Landfill		Disposed off-base, DPDO	
Fuel Systems Shop	60	Jet Fuel (JP-4)	2500 gal/yr				Recycle off-base generator	Reused on-base, FTP
		Solvent (PD-680)	55 gal/yr.			Reused on-base, FTP	Disposed off-base, DPDO; Recycled off-base, gen.	Recycled off-base, DPDO

TABLE IV-1. (Continued)

Shop Name	Location (bldg. no.)	Waste Material	Waste Quantity	Method(s) of Treatment, Storage & Disposal (1940 1950 1960 1970 1980)
64th Field Maintenance Squadron (FMS) (Continued)				
Inspection Branch	70	Hydraulic Fluid Solvent (PD-680) Oil	400 gal/yr 300 gal/yr 100 gal/yr	Reused on-base FTP; Disposal off-base, DPDO Recycled off-base, gen.; Recycled off-base, DPDO
Non-Destructive Inspection Branch	80	Penetrant (Aromatic Naptha)	110 gal/yr	Disposed off-base, DPDO
		Emulsifier (Petroleum Base)	60 gal/yr	Sanitary Sewer; Recycled off-base, DPDO
		Developer	700 gal/yr	
		Fixer (following silver recovery)	700 gal/yr	Stormdrain, oil sep. and Industrial Lake
		Trichloroethane (empty spray cans)	50/yr	Disposed off-base, trash disposal
		Silver	40 lbs/yr	Recycled off-base, DPDO
Corrosion Control	102	Paint Remover	800 gal/yr	Stormdrain, oil sep. and Industrial Lake
		Lacquer Thinner	50 gal/yr	Reused on-base, Fire Training Pit; Recycled off-base via generator Disposed off-base, DPDO
		Aircraft Soaps	1500 gal/yr	Stormdrain, oil sep. and Industrial Lake
		Various lacquers, Polyurethane paint	Overspray	Stormdrain, oil sep. and Industrial Lake
Flight Simulation	990	Hydraulic Fluid	300 gal/yr	Reused on-base, FTP; Disposal off-base, DPDO Recycled off-base, gen.; Recycled off-base, DPDO
64th Organizational Maintenance SQ (OMS)	45,88,34	Synthetic Oil Hydraulic Fluid	400 gal/yr 550 gal/yr	Reused on-base, FTP; Disposal off-base, DPDO Recycled off-base, gen.; Recycled off-base, DPDO
		Jet Fuel (JP-4)	1300 gal/yr	Reused on-base, FTP; Disposal off-base, DPDO Recycled off-base, gen.; Reused on-base, FTP, Reused on-base

TABLE IV-1. (Continued)

Shop Name	Location (bldg. no.)	Waste Material	Waste Quantity	Method(s) of Treatment, Storage & Disposal: 1940	1950	1960	1970	1980
64th Student Sq. Learning Center Photo Lab	73	Tray Cleaner Developer	24 gal/yr 240 gal/yr	Stormdrain, oil separator, and Industrial Lake				
		Fixer	240 gal/yr	Stormdrain, oil separator, and Industrial Lake			Recycled off-base, gen.	
Fuels Management Branch	FUL	Jet Fuel (JP-4)	500 gal/yr				Reused on-base, FTP	Reused on-base
	Flightline	Jet Fuel Spills	2900 gal/yr			Surface disposal (evaporation)		
Transportation Division, Motor Pool	366	Motor Oil Anti-freeze	1000 gal/yr 200 gal/yr			Recycled off-base, generator		Dispose off-base, DPDO
		Hydraulic Fluid	100 gal/yr	Industrial Lake		Recycled off-base, generator		Recycled off-base, DPDO
		Battery Fluid	5 gal/yr		Stormdrain, oil separator, and Industrial Lake			Recycled off-base, generator
		Paint Thinner (over-spray)	30 gal/yr	Burned		Recycled, DPDO	Stormdrain, oil sep. and Industrial Lake	
		Solvent	108 gal/yr	Burned		Recycled, DPDO	Recycled off-base, gen. Recycled off-base, DPDO	
Base Exchange/ Service Station	450	Motor Oil Solvent	400 gal/yr 300 gal/yr				Recycled off-base via generator	
Special Services Auto Hobby Shop	503	Motor Oil	200 gal/yr	Stormdrain, oil separator, and Industrial Lake			Disposal off-base, DPDO; Recycle off-base, generator	
		Solvent	500 gal/yr				Disposed off-base, DPDO; Stormdrain, oil sep., & Indus. Lake	Recycle off-base, generator
Protective Coating Shop	554	Paint Thinner	50/yr	Burned	Landfill		Dispose off-base, trash disposal	
		Spray Paint Cans	80/yr		Landfill		Dispose off-base, trash disposal	
		Paint Cleaner (Kerosene)	55 gal/yr			Reused on-base, FTP	Dispose off-base, DPDO Recycled off-base, generator	Recycle off-base, DPDO

TABLE IV-1. (Continued)

Shop Name	Location (bldg. no.)	Waste Material	Waste Quantity	Method(s) of Treatment, Storage & Disposal: 1940 1950 1960	1970	1980
Transportation Division, Motor Pool (Continued)						
Power Production	552	Lube Oil	220 gal/yr	Recycle off-base, DPDO; Reuse on-base, FTP	Disposed off-base, DPDO; Recycled off-base, generator	Recycle off-base, DPDO →
		Solvent/Rinsewater Anti-Freeze Battery Acid	50 gal/yr 50 gal/yr 15 gal/yr		Surface disposal (Evaporation); Stormdrain, oil sep. & Indus. Lake	Surface disposal (Evaporation); Stormdrain, oil sep. & Indus. Lake →
Energy Monitoring	553, 537	Biocide (Balta K-150)	21 gal/yr		Stormdrain, oil separator, Industrial Lake	Stormdrain, oil separator, Industrial Lake →
Control Center	930, 1300	Cooling Tower Water Treatment (Diphosphonic Acid, Caustic Soda)			Stormdrain, oil separator, Industrial Lake	Stormdrain, oil separator, Industrial Lake →
Entomology	2003	Pesticides	500 gal/yr		Surface disposal (evaporation)	Reused on-base →
USAF Hospital	1300	Mercury Amalgam Silver	25 lbs/yr 46 lbs/yr		Recycled off-base, DPDO	Recycled off-base, DPDO →

not generate hazardous waste, or have generated insignificant quantites of hazardous wastes, were eliminated from Table IV-1.

In general, shop wastes have been drummed or stored in tanks prior to contract disposal off-site. These drums are generally stored at the buildings in which the wastes were generated until drum pick-up. Much of the material, especially waste oils, hydraulic fluid, and solvents, are contracted out for recycling.

Other identified methods of waste disposal are through the Defense Property Disposal Office (DPDO), sanitary sewer, and the storm sewer. Waste discharged to the storm sewers goes to the Industrial Waste Lake. Most influent to this lake passes through an oil/water separator. The sanitary sewage passes through a sewage treatment plant. The liquid is discharged to the Sewage Lake, and the sludge is spread on grassy areas throughout the base, as will be discussed in Section IVB-7.

Brief descriptions of the industrial shops which generate hazardous wastes are provided in the following paragraphs. Refer back to Table IV-1 for information on the disposal methods of specific wastes.

- Flightline Support: General aircraft maintenance is provided by the Flightline Support shops housed in Facilities 45 and 98. Wastes generated from this area include synthetic oil, hydraulic fluid, incidental fuel spills and oily stormwater runoff.

- Aerospace Ground Equipment (AGE) Maintenance Shop: The AGE Maintenance Shop is located in Facility 50. This shop is responsible for repair, maintenance, and periodic inspection of all aerospace ground equipment. Wastes generated include hydraulic fluid (120 gal/yr), PD-680 (600 gal/yr), turbine oil (300 gal/yr) and cleaning compound (600 gal/yr).

- Vehicle Maintenance: The Vehicle Maintenance Shop is located in Facility 366. Wastes generated during the repair and maintenance of motor vehicles include engine oil (660 gal/yr), hydraulic fluid (60 gal/yr), kerosene (660 gal/yr), solvent (660 gal/yr), sulfuric acid (240 gal/yr), aircraft soap (660 gal/yr), and hydraulic acid (5 gal/yr).

- Fuel Systems Shop: The Fuel Systems Shop is located in Facility 60. This shop is responsible for repairing and maintaining all aircraft fuel systems. Wastes generated from this area include waste fuels (1000 gal/yr) and PD-680 (55 gal/yr). Previously (pre-1976), this shop was called Fuel Cell Replacement Shop and was located in Facility 96.

- Civil Engineering (CE) Paint Shop: The CE Paint Shop is located in Facility 554. This shop generates a mixture of paint thinners, pigments (combined 50 gal/yr) and empty paint ca. : (175/yr).

- POL Operations: The POL (Petroleum, Oil and Lubricants) Operations are located in the POL storage area at the southeast end of the Flightline. This operation generates waste JP-4 (1440 gal/yr), ether, MOGAS and diesel fuel, and solvents/kerosene.

- Avionics: The Avionics Shop is located in Facility 52. Prior to 1972, this shop used trichloroethylene.

- Flight Simulator: The flight simulator is located in Facility 930. Wastes generated from this shop include hydraulic oil and PD-680.

- Corrosion Control: The Corrosion Control Shop is located in Facilities No. 59, 96 and 102. Corrosion control activities include cleaning, stripping, sanding, wiping, priming, repainting, and stenciling aircraft and ground support equipment. Wastes generated in this shop include a comingled mixture of methyl ethyl ketone (MEK) (no longer used), toluene, methyl isobutyl ketone (MIBK), lacquer thinner, acetone, magnus magnusol and alodine.

- Aircraft Battery Shop: The Aircraft Battery Shop is located in Facility 52. Wastes generated from this area include nickel-cadmium batteries (250/yr), sulfuric acid (15 gal/yr), cadmium-contaminated potassium hydroxide (30 gal/yr), and PD-680 (30 gal/yr).

- Wheel and Tire Repair: The Wheel and Tire Repair and Replacement Shop is located in Facility 52. Waste materials generated from this shop include spent paint remover and PD-680 (1320 gal/yr), and tires.

- Engine Maintenance: The Engine Maintenance Shop is located in Facility 52. This shop generates waste PD-680, fuels, hydraulic fluid and synthetic oil.

- Non-Destructive Inspection (NDI) Laboratory: The NDI Laboratory is located in Facility 89. Non-destructive testing methods, including X-ray, magnaflux, and ultrasound, are performed to determine material defects of aircraft structures, component parts, and related ground equipment. Wastes generated include penetrant (110 gal/yr), emulsifier (110 gal/yr), developer (540 gal/yr), trichloroethane (50 gal/yr), and magnaglow inspection oil (165 gal/yr).

- Pneudraulics and Aircraft Maintenance Shop: The Pneudraulics and Aircraft Maintenance Shop is located in Facility 70. The Pneudraulics Shop services and repairs all aircraft pneumatic and hydraulic equipment. The Aircraft Maintenance Shop provides maintenance to aircraft. Wastes generated from these areas include synthetic oil, hydraulic fluid, engine oil and PD-680.

- Power Production and Exterior Electric Shop: The Power Production and Exterior Electric Shop is located in Facility 562. This shop uses sulfuric acid (48 gal/yr), solvents (110 gal/yr), antifreeze (50 gal/yr), lubrication oil (220 gal/yr) and transformer oil (50 gal/yr). Although most of the transformers have not yet been tested, the majority of those tested

do not contain PCB (especially the pole-mounted type). There are no known leaking transformers containing PCB at the present time.

- Engine Maintenance Test Cell: The Engine Test Cell is located in Facility 40. This facility uses JP-4 (288,000 gal/yr), synthetic oil (900 gal/yr), PD-680 (420 gal/yr), oil (36 gal/yr) and hydraulic fluid (30 gal/yr).

- Chemical Cleaning Shop: The Chemical Cleaning Shop is located in Facility 53. This shop is generally used to clean landing gear for inspection, repair and repainting. This shop uses paint remover (600 gal/yr), trichloroethane (60 gal/yr), carbon remover (660 gal/yr), caustic (600 gal/yr), potassium permanganate (600 gal/yr), phosphoric acid (180 gal/yr), cleaning compound (660 gal/yr) and various paint pigments.

- Plating Shop: The Plating Shop is located in Facility 59. This shop is used to refininsh landing gear. Chemicals used in this shop are chromic acid (1 gal/yr), cadmium oxide solution (2 gal/yr), caustic (2 gal/yr), sulfuric acid (2 gal/yr), hydrochloric acid (0.5 gal/yr), and sodium cyanide (2 gal/yr). It is likely that the Plating Shop was significantly larger in the past. Modern aircraft have much less need for plating operations.

- Machine Shop: The Machine Shop is located in Facility 59. The shop uses PD-680 (20 gal/yr), oil (2 gal/yr) and hydraulic fluid (11 gal/yr).

- Accessory Repair Shop: The Accessory Repair Shop is located in Facility 52. This shop uses carbon remover (60 gal/yr), corrosion preventive (60 gal/yr), lubrication oil (60 gal/yr), PD-680 (300 gal/yr) and trichloroethane (30 gal/yr).

- Photo Shop: This shop is run by a contractor in Facility 73. It discharges 144 gal/yr of mixed waste, developer, fixer and cleaner.

b. Fuels Management

The Reese AFB Fuels Management storage system includes a number of above ground and underground storage tanks and pipelines located throughout the base. Table IV-2 is a summary of fuel storage capacities. A more detailed analysis of fuel storage by tank capacity, fuel type, and including liquid oxygen (LOX) storage facilities is presented in Appendix E. Figure IV-1 shows the approximate locations of the different fuels storage areas.

Most of the large (10,000 gallon or greater) tanks are within the POL storage area located near the south end of the parking apron. There are four large JP-4 surface tanks in this area, each surrounded by a diked area of sufficient volume to contain any spills. All other tanks in this area are underground. Two tanks contain diesel and two additional tanks contain MOGAS (leaded and unleaded automotive gas). All tanks are constructed of welded steel. Underground tanks are coated with corrosion inhibitor and tank volumes are monitored periodically to assure early detection of potential underground leaks. Four large inactive underground tanks once used for MOGAS, but now filled with a preservative (i.e., "pickled") are also located in the POL storage area. Three other large underground gasoline storage tanks are located at the Base Exchange service station.

With one exception (the 2300 gallon JP-4 tank at Facility 3170, Fire Training), all nine medium size (1000-10,000 gallon) fuel storage tanks are buried. The locations of these tanks are indicated in Figure IV-1.

A small (less than 1000 gallon) underground kerosene storage tank is located in the POL storage area. In addition, 17 small capacity diesel tanks (<1000 gallon, two surface and 15 buried) exist on Reese. Facilities 40 and 60 each have a small underground JP-4 tank.

TABLE IV-2. SUMMARY OF ACTIVE POL STORAGE CAPACITIES, REESE AFB

Material	No. of Tanks	Maximum Tank Volume (gal)	Minimum Tank Volume (gal)	Total Storage Volume (gal) (Shell-Rated Capacity)*
JP-4	8	628,328	500	907,734
Diesel	24	12,200	110	34,540
MOGAS	9	12,200	1000	66,400
Kerosene	1	-	-	585

* In actual practice, Reese uses a safe-fill capacity which is a volume 5% to 10% less than the shell rated capacity, depending on fuel type.

SOURCE: Reese Plan 705.

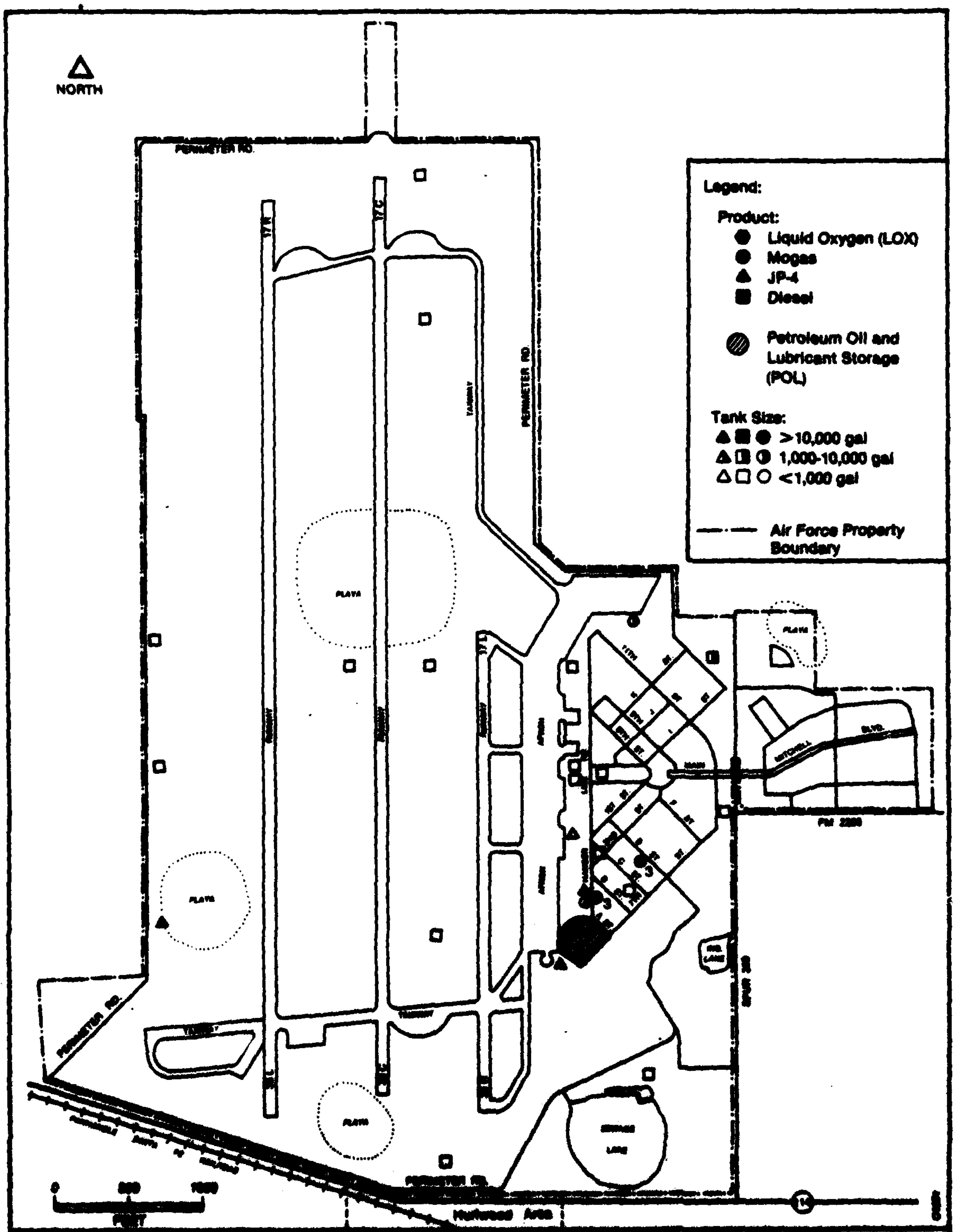

Figure IV-1. Fuel and Other POL Storage Areas, Reese AFB, Texas.

Though technically not a fuel, liquid oxygen (LOX) storage facilities are included here. Two surface LOX tanks with a total rated volume of 7000 gallons are located within a fenced area at the northeast corner of the apron.

All fuels are delivered to Reese AFB by tank truck, with approximately 24,000,000 gallons of JP-4 being purchased per year for the past 20 years. On base, JP-4 is transported by a fleet of 16 R-9 fuel trucks, each with a capacity of 5,000 gallons. There is no hydrant fueling system at the flightline. Diesel and MOGAS are transported by two L-300 fuel trucks, each with 1,200 gallons capacity.

c. Pesticide Utilization

Reese AFB has conducted a pest control program since the base opened. The program was initially implemented by the Road and Ground Shop. However, in recent years, the responsibilities for herbicides and other pesticides applications were taken over by the Entomology Shop. The pesticide program involves routine and specific job order chemical application and spraying. Pesticides are stored on base in Building 2003. Appendix F includes a list of pest control chemicals in stock and/or used during the past year, with estimates of annual consumption and methods of disposal, where this information is available.

Pesticides at Reese AFB are used primarily for mosquito and other insect control, tree protection and weed control purposes. Interviews with base personnel revealed no knowledge of pesticide spills or land disposal of any off-spec or outdated chemicals in any of the base landfills. A small volume of waste pesticide is known to have been disposed in the Southwest Landfill (Site D-1).

Mixtures of JP-4 and kerosene were applied to both the Sewage and Industrial Lakes in the past to control cattails. Until about 1972, waste

oils were used on the golf course to outline the fairways. Toxaphene, a potent pesticide was used in the Sewage Lake on at least one occasion between 1959 and 1965 to kill the inhabiting Tiger Salamanders which at one time were estimated to number approximately 28,000. The quantity of chemical used is unknown, but is suspected to have been excessive. By 1977, however, the concentration in Sewage Lake was below the limit of analytical detection.

Past disposal practices for waste pesticides and pesticide containers are undocumented in base records. However, several interviewees indicated that the most common practice was to salvage empty containers, where feasible. Current practice is to triple-rinse containers, with rinse water going to the industrial drain, crush containers and dispose of them in the active landfill located in the southwest corner of the base. Unused or out-dated materials are handled by DPDO and are transported off-base and disposed in a RCRA-permitted facility.

d. Base Hospital and Laboratory Operations

Reese AFB operated an approximately 25-bed composite medical facility which provides clinical and dental services to base personnel. A number of toxic materials are used by the hospital in routine operations. An itemized list of these materials with estimated annual quantities is provided in Appendix F. Hospital personnel interviewed indicated that each office/lab utilizing hazardous materials inits activities is individually responsible for proper handling, storage, and disposal of used or excess supplies.

Two past instances of hospital waste materials being landfilled were identifed. In 1951, lead from the X-ray lab was reportedly landfilled, while there was another report of ether being disposed in the Southwest Landfill in the early 1970's.

2. Description of Waste Disposal Methods

Reese AFB has utilized a variety of disposal techniques for hazardous and non-hazardous wastes throughout its 43 year history. These methods are listed in Table IV-3 and are described briefly in the following paragraphs. A detailed analysis of individual sites is provided in Section IV-B.

Refuse generated at Reese AFB includes paper, garbage, glass, metal, and other components of general municipal refuse. Refuse was disposed of on base in a sanitary landfill until 1 July 1975 -- effective date for a contract with the City of Lubbock for collection and disposal.

Household refuse generated by personnel stationed at the Terry County Auxiliary Field is burned in small trash barrels or disposed on-site in shallow landfill trenches.

Construction debris consisting of wood, concrete, asphalt, wire, asbestos shingles, etc. was disposed at several sites throughout the history of the base. With the exception of asbestos, no hazardous wastes are known to have been disposed at these construction fill sites. Hazardous wastes such as paint thinners and removers are generated by facilities on the base where aircraft are stripped of paint and repainted. Occasionally some waste acids containing Cd and Cr are produced by the electroplating shop when a vat must be emptied for maintenance or replacement. Although some reports indicate this was landfilled, it is currently disposed of by DPDO.

Since the 1970's most hazardous wastes generated by Reese AFB are either re-used on base or processed through DPDO for off-base recycle or disposal. However, in the past, hazardous wastes are known to have been disposed in at least one base landfill, and continue to enter the Industrial Waste Lake and Sewage Lake.

TABLE IV-3. WASTE DISPOSAL METHODS - REESE AFB

Method of Disposal	Status Discontinued	Status Continuing
Landfill - Sanitary	X	
Landfill - contruction and miscellaneous		X
Incineration		X
Surface impoundment		X
Fire training exercises (burning)		X
Re-cycle/re-use (on-base)		X
Off-base disposal (DPDO)		X

During the 1940's and 1950's, virtually all wastes were landfilled or burned in a gas fired incinerator that formerly existed near the sewage treatment plant. The base hospital operates its own incinerator which is used primarily for the destruction of pathological tissues and cultures. A third incinerator existed on base, and was used only for the disposal of classified documents.

Fire training exercises provided a means of disposal for waste oils, solvents, and Avgas. Six fire training areas were identified in the review of base records and in interviews with base personnel. Of these, only one (one on-base and one at the Terry County facility) remain active, using JP4.

B. Disposal Site Identification, Evaluation, and Hazard Assessment

As a result of Phase I activities at Reese AFB, 36 sites/areas of potential environmental concern were identified. A summary listing of these sites, including a brief description of the location and operation(s) conducted is provided in Table IV-4.

In the following sections, each of the sites is described in greater detail. Based on the information available, a determination of the potential for hazardous chemical migration from the site was made. Those sites determined to pose a significant potential threat to human health and the environment via migration of hazardous constituents resulting from past operations were analyzed using the Hazard Assessment Rating Methodology (HARM). The Decision Tree logic used to determine whether each site should proceed to the HARM rating step is outlined in Table IV-5.

Screening of the original 36 sites resulted in 9 sites proceeding to the HARM model ranking step. These sites, along with their HARM scores, are summarized in Table V-1 (Conclusions). The remaining sites, though determined to require no further study in their present condition,

TABLE IV-4. COMPREHENSIVE LISTING OF POTENTIAL AREAS OF ENVIRONMENTAL CONTAMINATION IDENTIFIED AT REESE AFB, TEXAS

Site #	Description	Site Status*
D-1	Landfill, southwest corner of base	A
D-2	Landfill, south end of primary instrument runway	I
D-3	Landfill, east of Sewage Lake	I
D-4	Landfill, north of Sewage Lake	I
D-5	Landfill, west of Sewage Lake	I
D-6	Landfill, Terry County Auxiliary Field	A
D-7	Landfill, eastern boundary of Hurlwood acquisition	I
D-8	Rubble area, playa bed near softball field	I
D-9	Rubble area, northeast corner of parking apron	I
D-10	Rubble area, northeast corner of base	I
D-11	Rubble area/landfill, northwest corner of base	I
D-12	Rubble area, playa bed north of active fire training area	I
D-13	Rubble area, between south ends of primary instrument runway and runway B	I
D-14	Rubble area, center of office area	I
SI-1	Surface impoundment, Industrial Waste Lake	A
SI-2	Surface impoundment, Sewage Lake	A
SI-3	Drainage impoundment, for runoff from active fire training area (FT-1)	A
SI-4	French drain, vicinty of CE paint shop	I
FT-1	Fire training area, west of south end of runway A	A
FT-2	Fire training area, east of taxiway 10	I
FT-3	Fire training area, northwest bank of Sewage Lake	I
FT-4	Fire training area, east of north end of primary instrument runway	I
FT-5	Fire training area, north end of taxiway 10	I
I-1	Incinerator, near sewage treatment plant	I
I-2	Incinerator, Base hospital	A
I-3	Incinerator, center of office complex	I
SP-1	Spill, POL storage area (Aquasystem)	-
SP-2	Spill, parking apron	-
SP-3	Spill, Base gas station	-
S-1	Storage area, PCB's, #2108	A
S-2	Storage area, hazardous wastes, #2110	I
S-3	Storage area, salvage yard	A
S-4	Storage area, drums, open area near salvage	A
S-5	Storage area, underground waste oil tank, #450	A
S-6	Storage area, underground waste oil tank, #503	I
SL	Sludge spreading areas	A

* A = active; I = inactive.

TABLE IV-5. SUMMARY OF DECISION TREE LOGIC FOR ALL SITES IDENTIFIED IN THE REESE PHASE I STUDY

Site #	Description	Potential for Contamination	Potential for Contaminant Migration	Potential for other Environmental Concerns	Refer to Base Environmental Program	Rate Using HARM
D-1	Landfill, southwest corner of base	Yes	Yes	N/A	N/A	Yes
D-2	Landfill, south end of primary instrument runway	No	N/A	Yes	Yes	No
D-3	Landfill, east of Sewage Lake	No	N/A	No	No	No
D-4	Landfill, north of Sewage Lake	Yes	Yes	N/A	N/A	Yes
D-5	Landfill, west of Sewage Lake	Yes	Yes	N/A	N/A	Yes
D-6	Landfill, Terry County Auxiliary Field	No	N/A	No	No	No
D-7	Landfill, eastern boundary of Hurlwood acquisition	No	N/A	No	No	No
D-8	Rubble area, playa bed near softball field	No	N/A	Yes	Yes	No
D-9	Rubble area, northeast corner of parking apron	No	N/A	Yes	Yes	No
D-10	Rubble area, northeast corner of base	No	N/A	Yes	Yes	No
D-11	Rubble area/landfill, northwest corner of base	Yes	Yes	N/A	N/A	Yes
D-12	Rubble area, playa bed north of active fire training area	No	N/A	Yes	Yes	No
D-13	Rubble area, between south ends of primary instrument runway and runway B	No	N/A	Yes	Yes	No
D-14	Rubble area, center of office area	No	N/A	Yes	Yes	No
SI-1	Surface impoundment, Industrial Waste Lake	Yes	Yes	N/A	N/A	Yes
SI-2	Surface impoundment, Sewage Lake	Yes	Yes	N/A	N/A	Yes
SI-3	Drainage impoundment, for runoff from active fire training area (FT-1)	Yes	No	Yes	Yes	No
SI-4	French drain, vicinity of CE paint shop	Yes	Yes	N/A	N/A	Yes
FT-1	Fire training area, west of south end of runway A	Yes	Yes	N/A	N/A	Yes
FT-2	Fire training area, east of taxiway 10	Yes	No	No	No	No
FT-3	Fire training area, northwest bank of Sewage Lake	Yes	No	No	No	No
FT-4	Fire training area, east of north end of primary instrument runway	Yes	No	No	No	No
FT-5	Fire training area, north end of taxiway 10	Yes	No	No	No	No
I-1	Incinerator, near sewage treatment plant	Yes	No	No	No	No
I-2	Incinerator, base hospital	Yes	No	No	No	No
I-3	Incinerator, center of office complex	No	N/A	No	No	No
SP-1	Spill, POL storage area (Aquasystem)	Yes	Yes	N/A	N/A	Yes
SP-2	Spill, parking apron	Yes	No	No	No	No
SP-3	Spill, base gas station*	Yes	Yes	N/A	N/A	No
S-1	Storage area, PCB's, #2108	Yes	No	N/A	No	No
S-2	Storage area, hazardous wastes, #2110	Yes	No	N/A	No	No
S-3	Storage area, salvage yard	Yes	No	N/A	No	No
S-4	Storage area, drums, open area near salvage	Yes	No	N/A	No	No
S-5	Storage area, underground waste oil tank, #450	Yes	No	N/A	No	No
S-6	Storage area, underground waste oil tank, #503	Yes	No	N/A	No	No
SL	Sludge spreading areas	Yes	Yes	N/A	Yes	No

*Unconfirmed, opinion of investigators was mistaken for Aquasystem spill (SP-1).

still represent potential environmental concerns. If future activities will disrupt any of these sites, their potential for environmental impact should be re-evaluated in light of planned activities.

1. Landfills and Rubble Areas

Throughout its history, Reese has used a number of different areas on base for surface disposal of solid and liquid wastes. The locations of all landfills and rubble areas identified in this study are shown on Figure IV-2. The types of wastes which have been landfilled or landspread are very diverse. However, to facilitate characterization of individual sites, the following broad classification of waste types may be used:

Construction wastes - consist of asphalt, concrete, and demolition rubble. A potentially hazardous component, asbestos, should not be a problem unless disturbed.

Domestic wastes - consist of paper, cans, glass and other miscellaneous trash. Although hazardous materials may be included, they should be in minute quantities and constitute limited problems. A potential problem could be the formation of methane and hydrogen sulfide from the anaerobic decomposition of materials, particularly if garbage is present.

Industrial wastes - consist of spent acids, bases, pesticides, solvents, fuels and soil. Many of these materials are hazardous and have the potential for migration.

a. Site D-1 Landfill, Southwest Corner of Base

The site (hereafter, "Southwest Landfill") is the only active landfill within the base proper. The site which covers approximately 25 acres has had one or more disposal trenches active at any given time since the mid-1950's. At present, only two trenches for disposal of construction type wastes are in use. However, in the past, domestic and hazardous wastes

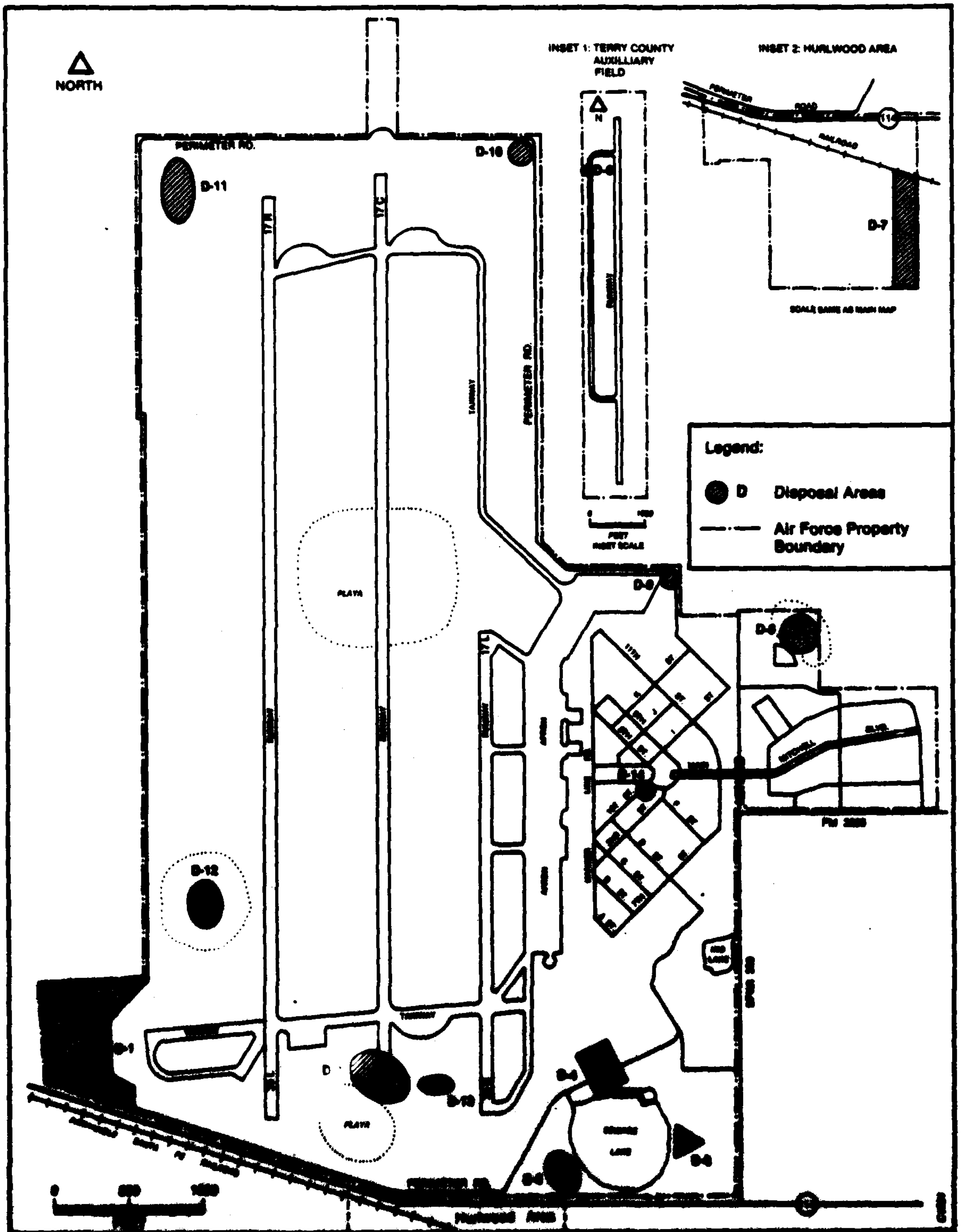

Figure IV-2. Locations of All Identified Landfills and Rubble Areas, Reese AFB, Lubbock and Terry Counties, Texas.

are also known to have been disposed at this site. Figure IV-3 depicts the distribution of all identified active and inactive trenches. Trenches for household and commercial wastes trending parallel to the north side of the site were closed in 1972. At that time, new trenches were opened for construction debris along the south edge of the area. The entire site was closed to general dumping in 1977. Thereafter, disposal was restricted to non-hazardous solid wastes only.

Unfortunately, in the early days of operation, no written records of the types and volumes of wastes and their exact disposal locations were kept. Although permits for dumping were required and weekly inspections were conducted from the mid-1960's onward, most of the information on the wastes in the southwest landfill came from interviews with former base employees.

Reportedly, during the late 1950's to early 1960's, a variety of waste acids and cleaning solutions were disposed of in the Southwest Landfill. Drums were transported to the site, drained, and the empty drums returned to the salvage yard. One estimate places the annual volume of these wastes at about 100 gallons during this period. Ohter interviewees recalled approximately thirty 55-gallon drums of unknown origin, four 32-gallon drums of paint chips and five 20-gallon containers of chromic acid being stored (and possibly dumped) at the landfill around 1976. All empty containers were returned for salvage.

Other wastes that were allegedly dumped at this site include scrap aircraft tire debris (late 1950's), tractor trailer loads of lead pipe from the old aquasystem (1960's), ether (volume unknown) from the base hospital, dredged sludge from the Industrial Waste Lake (early 1970's), and plating tank bottom sludges containing cadmium (1976 or 1977). Pesticides are also known to have been disposed in two 300' x 30' x 15' trenches located near the center of the site (see Figure IV-3).

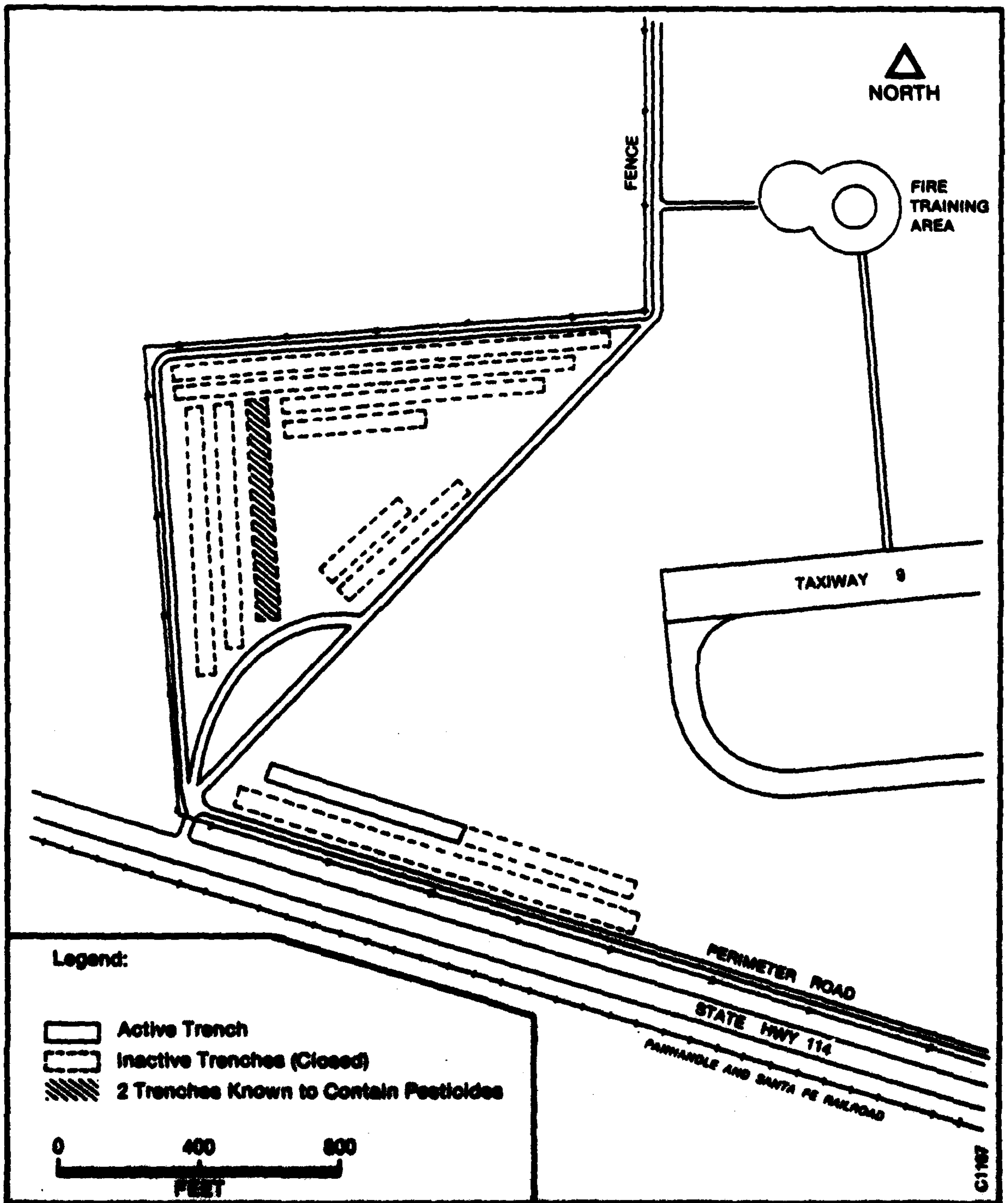

Figure IV-3. Distribution of Known Trenches in the Southwest Landfill (Site D-1).

The Southwest Landfill was rated using the HARM model primarily because of the known instances of disposal of hazardous wastes and the remaining uncertainties with respect to actual volumes. In addition, the naturally occurring soils in the disposal area are among the most permeable identified. Therefore, there is a greater potential for contaminant migration from this site than elsewhere where soils are clay-dominated and less permeable. The total HARM score for this site is 60.0.

b. Site D-2 Landfill, South End of Primary Instrument Runway

During the early 1960's and again in the 1980's, construction debris and domestic trash were disposed of in a playa existing at the end of the primary instrument runway. Subsidence over this landfill has adversely impacted the use of the runway.

Details regarding the wastes disposed in this landfill are sketchy. It is believed that the quantity of waste materials is moderate, but the precise location of trenches is unknown. The types of waste materials identified include concrete and asphalt debris, generally considered innocuous.

This site was not rated using HARM since all available evidence suggests that no hazardous wastes were disposed at this site.

c. Site D-3 Landfill, East of Sewage Lake

During the 1940's open trenches located east of the Sewage Lake were used for waste disposal. Generally these trenches ran north/south and contained construction/demolition lumber and miscellaneous trash. Most of this material was burned in the ditches, then covered over.

The exact locations of the trenches are not known. It is however, generally believed that moderate amounts of material were disposed. Furthermore, since the base was closed during most of the period of landfill operation, most of the disposed material consisted of contruction debris.

This site was not rated using the HARM model, since no evidence obtained during the records search or interviews suggested that hazardous wastes were disposed in this area.

d. Site D-4 Landfill, North of Sewage Lake

During the 1950's to the mid 1960's, trenches on the north side of Sewage Lake were used for waste disposal. Waste fuels, oils, construction debris, paint chips and solvent were all disposed in several east/west trending trenches. Allegedly water was sometimes present in the bottom of the trenches, and occasionally direct connections to the playa were observed. Subsidence over the trenches in the past was reported and continues to be a minor problem. Prior to 1946, household and commercial wastes were landfilled over a larger area identified by the Air Force, which included the D-4 site.

The quantity of material disposed in Site D-4 was large, and essentially all types of wastes, including some hazardous materials were disposed of in the trenches. Reported observations of direct interconnection between standing water in the trenches and the Sewage Lake suggest a high potential for contaminant migration. For these reasons, this site was rated using the HARM model and received a score of 68.

e. Site D-5 Landfill, West Side of Sewage Lake

During interviews with past base personnal, several east-west trending trenches were reported to have existed on the west side of the Sewage Lake. The trenches were probably used during the 1950's and early 1960's for disposal of all types of base-generated wastes that could have included industrial compounds and waste oils. The types and quantities of wastes, however, is speculative. The only physical evidence for the existence of a landfill at this site is reported areas of subsidence along the perimeter road that may now overlie the former trenches.

This site was rated using the HARM model based on limited evidence of potential contamination and a slight possibility of off-site migration due to the site's proximity to the base boundary. Due to the drainage pattern, however, any contaminant migration would be more likely to occur in the direction of the Sewage Lake. This site received a HARM score of 53.

f. Site D-6 Terry County Landfill

Wastes generated by Air Force personnel stationed at the Terry County Auxiliary Field are disposed in a small landfill trench located in the northwest section of the facility. The landfill includes limited construction debris and residues from burning domestic trash/garbage. The trench is active, the quantity of wastes disposed small, and the types of wastes are non-hazardous. For these reasons, the site does not present an environmental threat and does not require rating with the HARM model.

g. Site D-7 Landfill, Hurlwood Acquisition

A disposal area existed behind a cotton gin that formerly occupied part of the property in Hurlwood acquired by the Air Force in 1978. The wastes disposed reportedly consisted of only non-hazardous debris including miscellaneous trash from the gin. It is believed the disposal area did not accept any domestic or construction type wastes from residents of the town of Hurlwood.

On this basis, the site is not considered a hazardous waste disposal area and can be eliminated from further consideration.

h. Site D-11, Landfill, Northwest Corner of Base

This site reportedly consisted primarily of waste piles of asphaltic construction debris, resulting from runway demolition. However, allegedly in the early 1970's, thirty to fifty 55-gallon drums of material described as "too toxic for the landfill and lakes" were emptied into trenches cut into the construction debris. Two or three years later the debris was spread out over 3-5 acres along the northwest corner of the base.

This site was rated primarily on the basis of the alleged extreme toxicity of the wastes disposed in the 1970's, despite the fact that the potential for migration is low in this area of moderately low permeability soils.

There are several factors that contribute to the difficulty in rating this site: the lack of information on what exactly was dumped; the subsequent spreading of the hazardous waste-contaminated asphaltic debris over such a large area; and the amount of time that has elapsed since the occurrence. In light of the foregoing considerations, the HARM rating of 44 is subjective.

i. Miscellaneous Surface Disposal Areas

<u>Sites</u>:	D-8	Rubble area, playa bed near softball field
	D-9	Rubble area, northeast corner of parking apron
	D-10	Rubble area, northeast corner of base
	D-12	Rubble area, playa bed north of active fire training area
	D-13	Rubble area, between south ends of primary instrument runway and runway B
	D-14	Rubble area, center of office area

The demolition of runways and buildings on Reese AFB has resulted in the existence of numerous surface disposal areas listed above, which are characterized by concrete and asphaltic debris. Apparently the northwest landfill (Site D-11) was also of this type until it was allegedly used to dispose of toxic liquid wastes.

The actual boundaries of these rubble areas are typically difficult, it not impossible, to define, as are the waste quantities which range from small to large. The wastes however are generally considered innocuous. A possible exception may be asbestos-bearing roofing materials that are reportedly ubiquitous in these construction debris-type landfills. However, if left undisturbed, any asbestos is unlikely to become airborne where it would pose a threat to human health. Based on these considerations, the above listed sites are referred to the Base Bioenvironmental Engineer for consideration if future construction is planned at any of these locations. However, within the scope of this project, they may be eliminated from further consideration based on an absence of pathways for migration of the only potentially present hazardous constituent, asbestos.

2. Surface Impoundments

As discussed in the section on local geology, six playas exist within the boundaries of Reese AFB. Two of these are used as natural surface impoundments; one for effluent from the sewage treatment plant and the second for industrial waste streams from the shops and flightline. These sites were identified as having potential for environmental contamination, and are discussed below, along with two other sites where liquid wastes were disposed. The locations of all four sites are shown on Figure IV-4.

a. Site SI-1 Industrial Waste Lake

The Industrial Waste Lake is located just within the base boundary, south of the picnic area and west of the perimeter road (Spur 309). The impoundment covers approximately 4.5 acres in the center of a larger natural playa that extends off base property, across Spur 309. The part of the natural playa on base property has received storm drainage and industrial wastewater since 1942. Review of aerial photographs indicate that shortly after the base reopened (probably around 1950) the playa was drained and deepened, significantly reducing the actual industrial waste water containment area. In spite of this, during periods of heavy rainfall, the impoundment often overflowed, with wastewater at times covering almost the entire area of the natural playa, including the adjacent privately owned property across Spur 309.

In the early 1970's the Industrial Lake was again deepened with dredged material disposed in the southwest landfill (D-1). In 1977, a pump was installed in the Industrial Lake to prevent flooding. Before overflow occurs, water is pumped out of the Industrial Lake and into the Sewage Lake. In 1982, the system was further modified with installation of a one-way valve interconnecting the two halves of the playa under the Spur 309 road. This valve allows water to flow only into the Industrial Waste Lake from the drainage area on the private property east of the road.

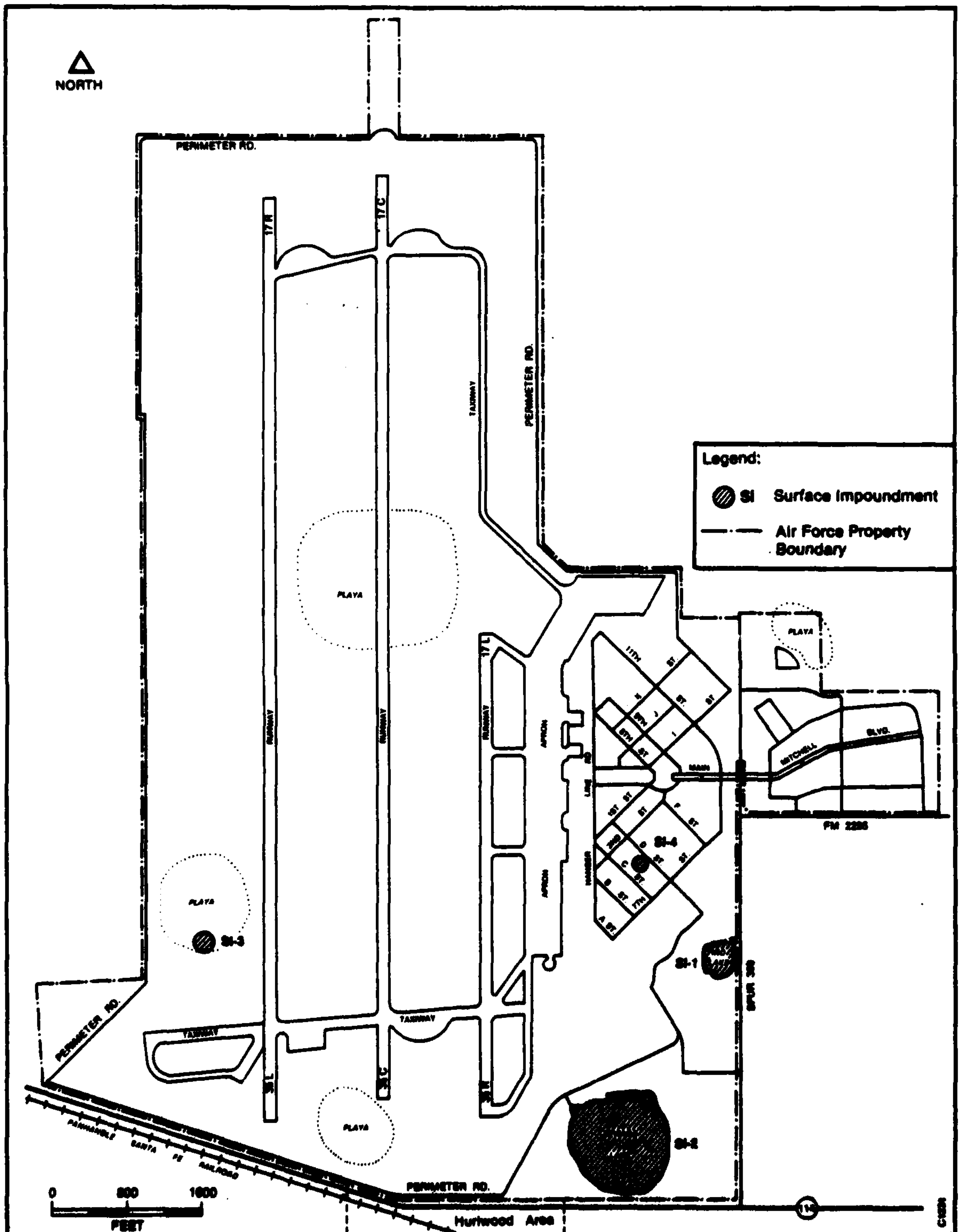

Figure IV-4. Locations of All Identified Surface Impoundments, Reese AFB, Texas.

Currently, the Industrial Waste Lake receives surface runoff from most of the base area. This includes drainage from the flightline and industrial shops. This wastewater routinely contains paint remover, drag-out from the plating tanks containing chromium, cadmium, and acids, oil and grease from the parking apron, detergents, etc.

A primary concern is the paint stripper which contains methylene chloride. In the past, the paint stripping waste was simply washed to the industrial drain. However, within the last year, the wastes are collected by a wet-vacuum process prior to a rinsing of the hangar floor. This dilute wastewater passes through an oil-water separator approximately 0.75 mile from point of final discharge into the Industrial Waste Lake. This revision in procedure should significantly reduce the amount of methylene chloride discharged to the lake. (Previous analyses of lake water samples have contained no methylene chloride.)

Periodic water analyses indicate that the Industrial Waste Lake has occasionally contained low concentrations of metals and volatile organic compounds. Bottom sediment and sludge samples contain several trace metals. However, E.P. Toxicity extractions indicate that these metals are in a relatively immobile form.

b. Site SI-2 Sewage Lake

The Sewage Lake is located just south of the Reese AFB sewage treatment plant where sewage is treated by a modification of the Hayes process which consists of screening, primary sedimentation, first-stage contact aeration, intermediate sedimentation, second contact aeration and final sedimentation. Effluent from final sedimentation is chlorinated and flows into two small in-series lagoons, eventually entering the main playa basin. The basin occupies approximately 35 acres in area, and the average water depth is 2m. The bottom consists of natural low-permeability clay which is featureless and devoid of vegetation and debris.

The playa basin was modified in 1941 to receive treatment plant effluent. After World War II, the base was closed until 1949 but continued to serve as a housing area; thus, the sewage facilities remained operative. Essentially, the basin has held water since 1941; however, on several occasions the water was drained and on at least one occasion, the pond was poisoned with toxaphene to kill salamanders. This was done to stock the pond with fish, all of which died shortly thereafter.

Chlorinated water from the Sewage Lake is currently used for golf course irrigation, and sewage digester sludge is spread and dried on the playa banks, along sections of the perimeter road, and on the golf course grounds. In the past, sludge was spread much more extensively throughout the base (see Section IVB-7 for a more detailed description).

Sampling data indicate that the Sewage Lake water quality is typical for a sewage lagoon. However, polynuclear aromatic hydrocarbons (PAH) have been detected in low concentrations in the sludge.

Historically, hazardous wastes have been disposed of in Sewage Lake. For instance, in 1963, a large volume of asphaltic debris from runway demolition was dumped into the lake. Also, until the early 1970's, diesel oil was periodically applied to the pond surface as a mosquitocide. For a short time between mid-1980 and early 1981, solvents, waste oils, and other industrial wastes from the flightline shops were introduced into the sewage system. Total throughput of flightline wastes during this period is estimated as hundreds of gallons.

Since 1977, the Sewage Lake has periodically received increments of flow from the Industrial Waste Lake via an overflow pump installed in the Industrial Lake. Thus, the Sewage Lake is a hazardous waste surface impoundment under RCRA, since it is directly connected to another known hazardous waste impoundment (the Industrial Lake).

The Sewage Lake was rated using the HARM model because the presence of hazardous constituents is confirmed albeit in low quantities; and there is the possibility of natural migration of these constituents through the soils. The practice of using Sewage Lake water for golf course irrigation creates an additional pathway for potential contaminant migration. The HARM score for this site is 68.

c. Site SI-3 Fire Training Impoundment

Near the active base fire training area (FT-1) is a small (8' x 60') trench filled with several inches of water. It is near the center of a playa that has been partially filled with concrete debris (D-12). A surface drain from the fire training pit discharges ~150 ft. from the trench. Also around the edges of the trench are deposits of ash-gray material, possibly discharged with drainage from the training area. There is no noticeable petroleum film on the water surface.

This impoundment collects local runoff which includes surface drainage from a construction landfill, the southern end of runway A and the fire training area. This site was determined not to represent a threat of contaminant migration since it is located on the relatively impermeable soils of a playa bed and in view of the low volumes of wastewater and high evaporation rate.

d. Site SI-4 Civil Engineering Paint Shop Trench

A trench (8' x 10' x 5' deep) with a gravel French Drain was used to dispose of paint thinners and cleaners. This trench was located between the paint shop and the railroad tracks (since removed). For several years in the 1960's, kerosene, toluene, acetone, and laquer thinner (methyl alcohol?) were drained into the pit. When the gravel became clogged with paint, the practice was discontinued and the ditch was backfilled.

The quantities of material disposed is unknown (probably small) and the exact boundaries of the site are speculative.

This site was rated using the HARM model because of the documented disposal of wastes containing hazardous chemicals, and the potential for migration resulting from dumping of these liquids onto a highly permeable surface. The HARM score for this site is 56.

2. Fire Training Areas

Fire fighting experience is gained by having installation personnel routinely extinguish or purposely set fires. These fires are started using 'waste' fuel and other flammables from the base. Until the 1970's a major compound utilized in fighting fuel fires was carbon tetrachloride. Since the mid-1970's, bromochloromethane and bromochlorodifluoromethane have been utilized. All of these fire fighting compounds as well as leaded aviation gas and JP-4 (often mixed with propanediol) can be expected to be contaminants at fire training areas.

Site FT-2, inactive since the mid-1960's, is typical of the fire training pits. Fuel thinners and solvents (6-12 drums) would be emptied onto some trash in an unlined pit. The fire would be started, allowed to burn until very hot, then put out. The unburned fuels and extinguishing agents would then be allowed to evaporate, percolate, or runoff. This activity would take place almost every weekend over a period of years.

At Reese AFB, five fire training areas were identified. Figure IV-5 illustrates their locations. All but one of the sites are now inactive. Two inactive sites (FT-4, 5) have been regraded and scattered as part of on-going construction activities, and the specific locations could not be identified. Another two inactive fire training locations (FT-3 and 2) are probably intact. One is on the edge of the sewage playa, the other near taxiway 10. The two active fire training sites are located just north of the southwest landfill (FT-1).

In summary, no environmental stress was observed at any of the inactive fire training areas. It is therefore concluded that they pose no significant risks to human health. Besides these facts, the location of the sites are not precisely determined and sampling would, therefore, be difficult. The active site (FT-1) is readily identifiable and is likely to contain contaminants in quantificable concentrations.

a. Site FT-1, Active Fire Training Area on Base

The active (since 1965) fire training site on base has a HARM rating of 54. This rating occurs from the presence and continued use of halogenated hydrocarbons and the unknown potential of migration.

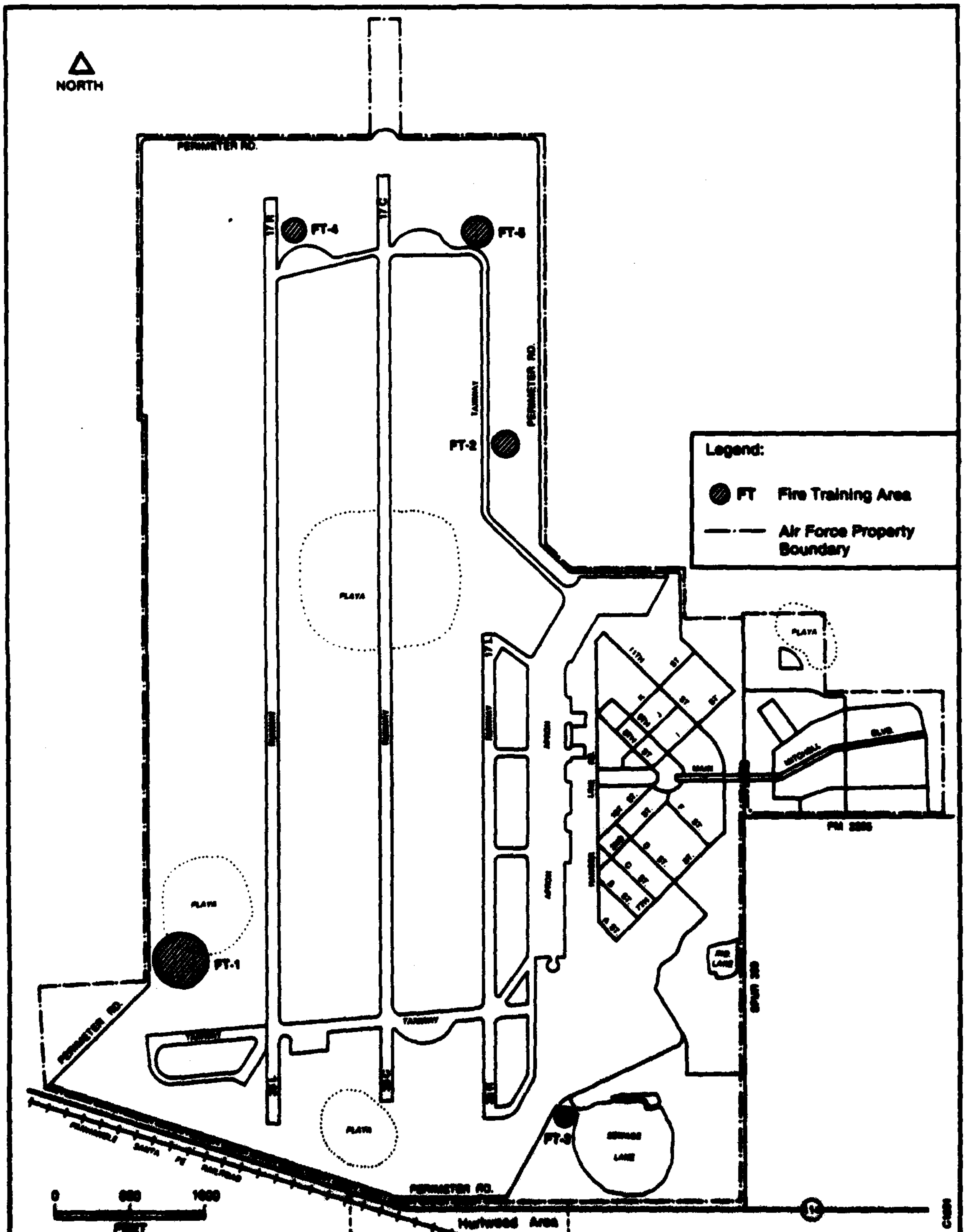

Figure IV-5. Locations of All Identified Fire Training Areas, Reese AFB, Texas.

4. Incinerators

Three incinerators have been used for disposal of a variety of wastes at Reese AFB during its history. Currently, only one is active (I-2). The largest incinerator (I-1) was demolished in the 1950's. Each of the incinerators is described in the following sections, and their locations are shown on Figure IV-6.

a. Site I-1 Incinerator, Vicinity of the Sewage Treatment Plant

A brick, natural gas-fired incinerator with approximately a 40 ft. chimney operated in an area near the sewage treatment plant from 1941 to the early 1950's. It was used to burn virtually all wastes generated by the base including domestic, construction and industrial wastes. It is generally believed that during the period the base was closed (1946 to 1949) few, if any, industrial wastes were incinerated.

The disposition of the residues from the incinerator is undocumented. Allegedly the natural gas burners were left on most of the time, possibly leading to complete combustion or even volatilization of most of the wastes.

Site I-1 was not rated using HARM as no evidence of environmental contamination was uncovered during the data review or in interviews.

b. Site I-2 Incinerator, Base Hospital

This incinerator is currently used primarily to destroy pathological wastes. It is fired with natural gas and has an afterburner system on the stack to assure complete incineration of all materials.

Site I-2 was not rated using HARM as no evidence of environmental contamination associated with incinerator operation was discovered in the records search or in interviews with base personnel.

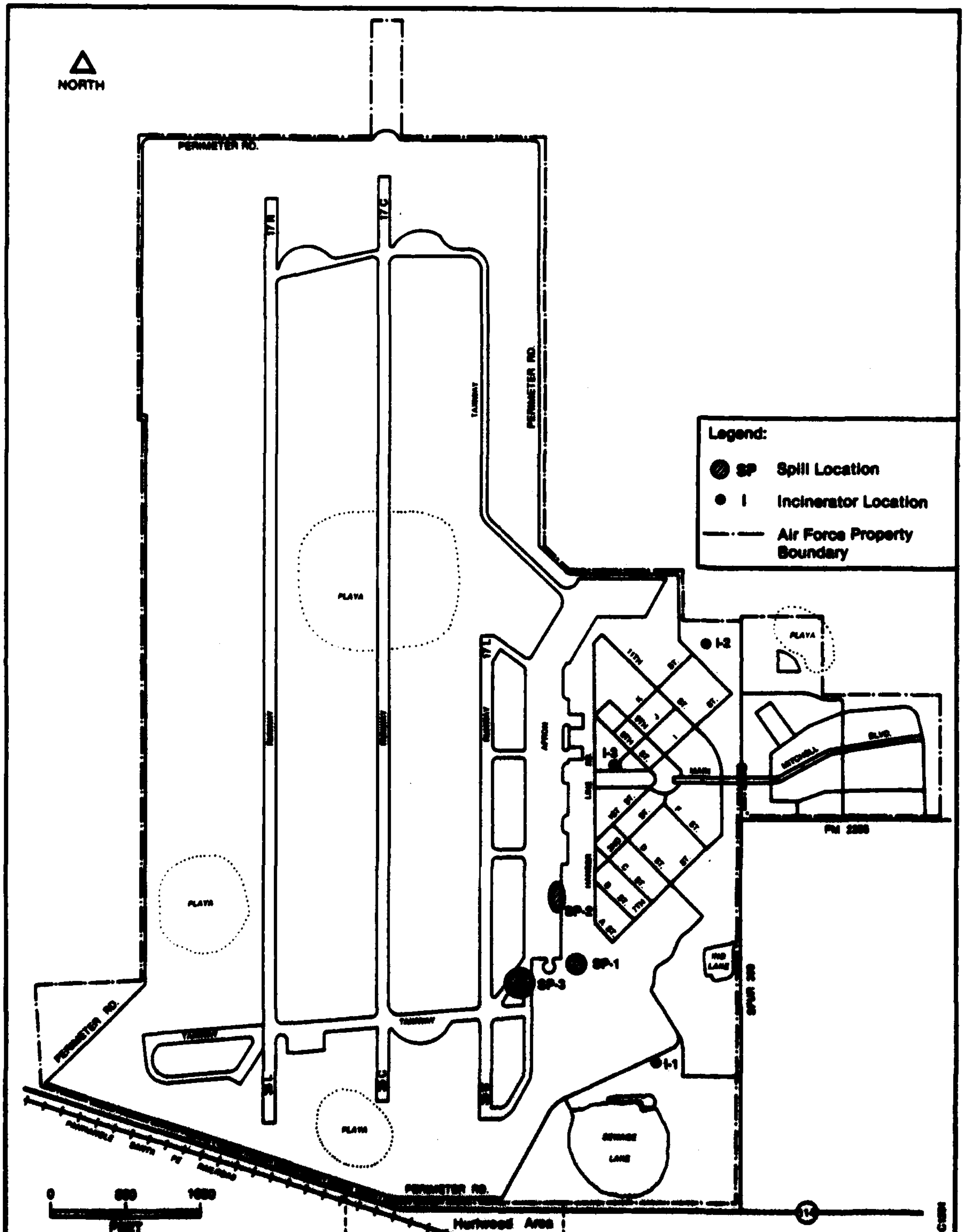

Figure IV-6. Locations of All Identified Fuel Spills and Incinerators, Reese AFB, Texas.

c. Site I-3 Incinerator, Base Command Headquarters

A small incinerator was used to destroy confidential material. No hazardous wastes were incinerated; thus this site does not constitute a hazardous waste disposal facility.

5. Spill Areas

Small spills have occurred on Reese AFB. These spills are generally cleaned up quickly, in compliance with all provisions of the base's Oil and Hazardous Substance Pollution Contingency Plan (Reese Plan 705), and do not have a significant environmental impact. Typical of these are small spills which routinely occur on the aircraft parking areas as a consequence of fuel expansion in the aircraft fuel tanks and routine engine maintenance. Small spills can also be expected from accidental overfilling of tanks and off-loading of fuel trucks.

Three larger fuel spills were reported during interviews with base personnel. The locations of these fuel spill areas are illustrated in Figure IV-6.

a. Site SP-1 Fuel Spill, POL Storage Area (Aquasystem)

During onsite interviews, it was learned that from approximately 1947 until the early 1960's, the POL storage area used an "aquasystem". This system was a network of underground Avgas tanks connected by 12" lead pipes which were supported on concrete pedestals. The entire system was buried at a depth of 10' to 12'. Water was used as part of the fuel delivery system to float the fuel upward in the tanks and through the pipelines.

In about 1949, a major leak in the system occurred which was recognized only after a nearby water supply well (#4) began pumping Avgas. By this time, it is estimated that on the order of 1000 gallons of mixed Avgas and water (mix ratio unknown) had been lost. The well was subsequently abandoned. Remedial actions taken to limit the damage included pumping gas from the well, excavation of contaminated soil, and repair of the leaking pipes. The excavated soil and the resulting pit and trenches were allowed to aerate prior to backfilling.

This site was rated using the HARM model based on direct evidence of migration of hazardous materials was provided by contamination of the ground water from well #4 in 1949 (Site SP-1 received a HARM score of 67). There is also the potential for continuing migration of whatever hydrocarbons may have been left.

b. Site SP-2 Fuel Spill, Parking Apron

One interviewer recalled a spill of JP-4 which occurred on the parking apron sometime between 1978 and 1980. He estimated that a volume of 60 to 70 gallons was spilled. Reportedly, the spilled fuel was rinsed to the storm drain and the apron was squeegied down.

Since the JP-4 spill occurred on the parking apron (an impermeable surface) and was promptly washed to the storm drainage system (which discharges to the Industrial Waste Lake after passing through an oil/water separator) this site is not considered to present an environmental hazard.

c. Site SP-3 Fuel Spill, Base Gas Station

Allegedly, in the early 1960's an Avgas spill occurred "near the base gas station." The volume of gas lost was not estimated, however, it was stated that a nearby well (#4) was contaminated with the gasoline.

We believe this site actually reflects the same incident that reportedly occurred in the POL storage area (SP-1) in 1949. The same well was reportedly contaminated. The discrepancies in the reported dates and locations of the spill are probably a result of it having occurred more than 20 years ago. We have therefore not rated this site, but have shown the location identified by the interviewee on Figure IV-6.

6. Waste Storage Sites

Several hazardous material and waste storage sites have been located on Reese AFB. These sites are areas of interest due to their potential for environmental contamination and were reviewed during the on-site survey. These sites are illustrated in Figure IV-7.

a. Site S-1 PCB Storage

The PCB storage area at Reese AFB is currently located in Bldg. 2108. No incidents of spills or leaks were reported from this area. In 1981, one or two leaking transformers were reportedly stored in Bldg. 73. According to the transformer labelling, they potentially contain PCB's. They were stored on concrete pads, with no external drainage, until they were disposed off-base.

b. Site S-2 Hazardous Waste Storage

Hazardous wastes were formerly stored at facility 2110. This area is no longer used and no incidents of leaks or spills were identified.

c. Site S-3 Salvage Yard

Empty drums and other salvageable waste materials are stored at facility 2104. No incidents of environmental contamination in this area have been reported.

d. Site S-4 Drum Storage

Drums (55 gal.) awaiting off-base disposal are stored on pallets. The area did not have a containment system until 1983. During a routine Texas Department of Health inspection, this inadequacy was discovered. At the same time, one bulging drum was found. It had not ruptured and the contents were transferred to another drum before any environmental damage occurred. These minor violations have been resolved.

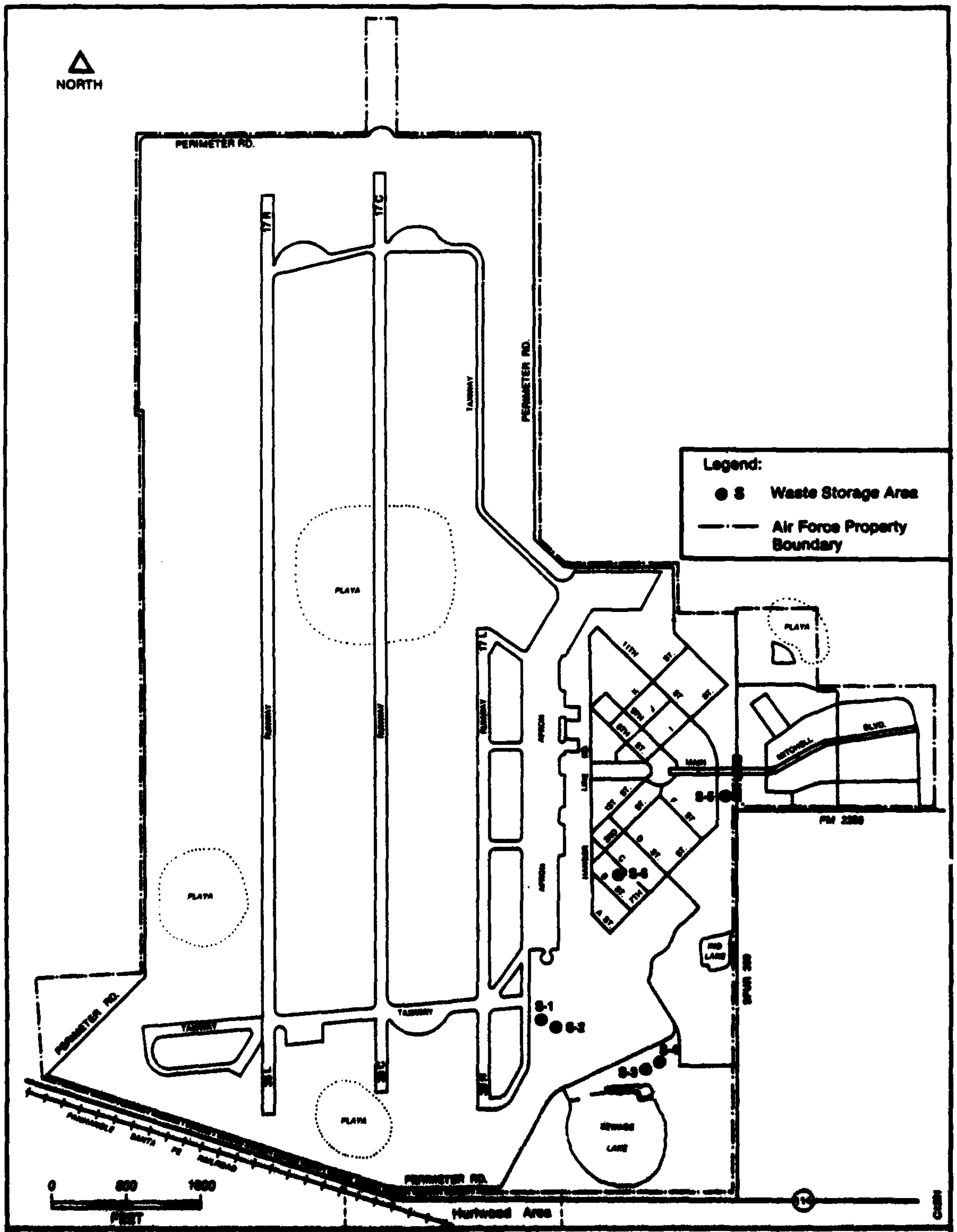

Figure IV-7. Locations of All Identified Waste Storage Areas, Reese AFB, Texas.

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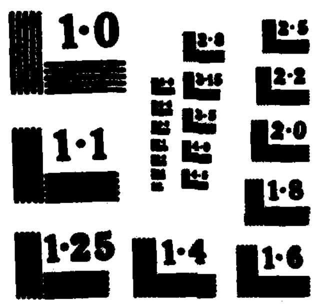
1·0
2·5
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2·0
1·8
1·25
1·4
1·6

e. Site S-5 Underground Waste Oil Storage Tank

A 550 gallon underground storage tank for waste automotive oil is located at Bldg. #450. This tank has been used since 1972. No incidents of leaks were reported.

f. Site S-6 Underground Waste Oil Storage Tank

A 5,000 gallon underground storage tank for waste automotive oil is located at Bldg. 503. No incidents of leaks have been reported.

7. Sewage Digester Sludge Spreading Areas

Throughout Reese AFB's history, sewage digester sludge has been used at many locations to fertilize grassy areas. Figure IV-8 shows the location where this practice is continuing as well as past spreading areas identified by interviewees. Currently, sludge is spread primarily along the perimeter road, on the north bank of the Sewage Lake, and on the golf course greens.

In actuality, areas that were at one time used for sludge spreading may be even more extensive than those shown on the map. Several interviewees agreed that "sludge has been spread at almost every place on the base where there's grass".

Analyses of the sewage sludge indicate that polynuclear aromatic hydrocarbons (PAH) are a minor constituent. However, at the levels detected, the PAH's do not constitute a health hazard.

A potential concern associated with the sludge is the suggestion that at some time prior to 1976, mixing of chromic acid with sewage sludge was a procedure used for waste acid disposal (USAF memo dated 30 April 1976).

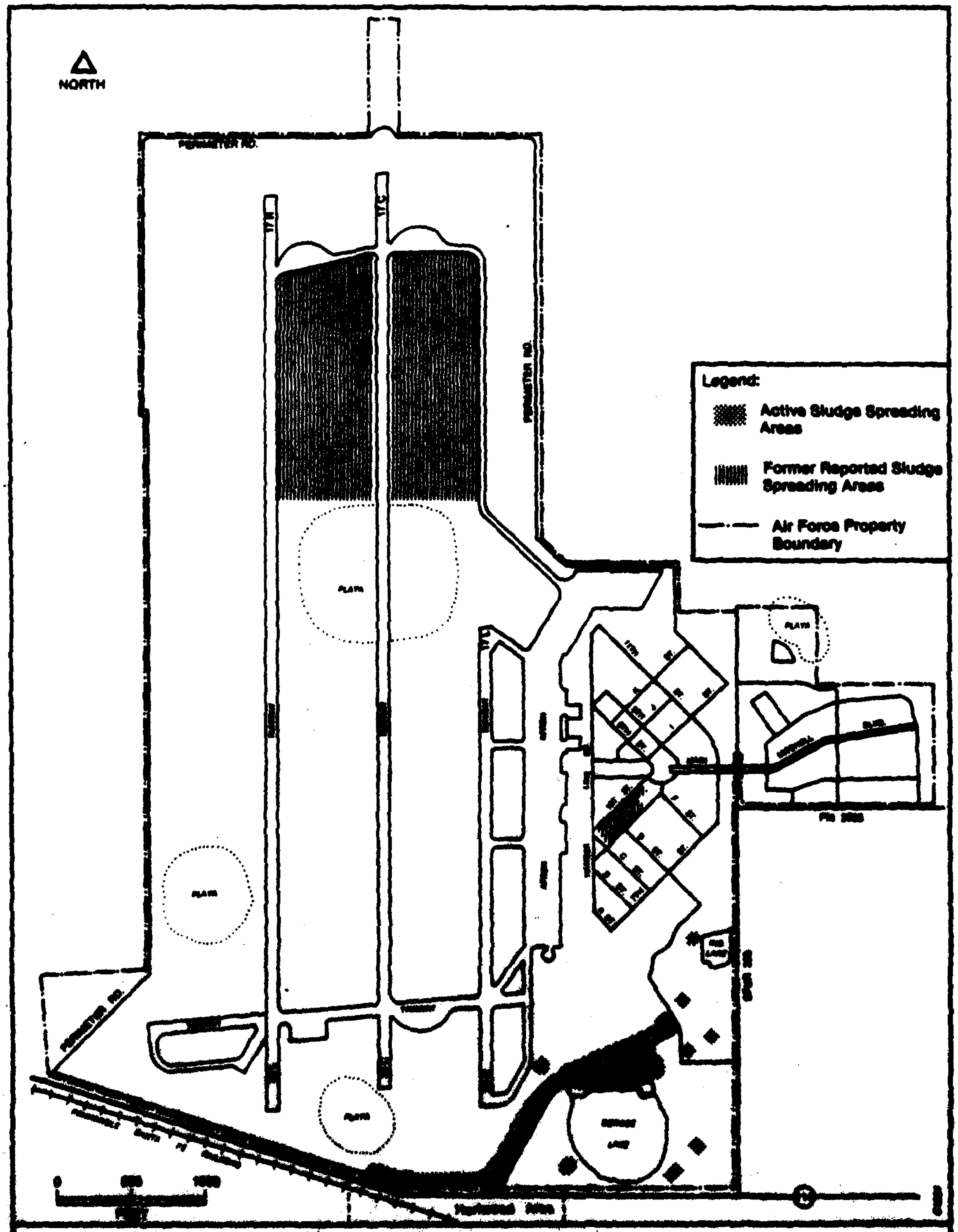

Figure IV-8. Locations of Sewage Digester Sludge Spreading Areas, Reese AFB, Texas.

The areas on the base where sludge spreading has occurred are too widespread and poorly defined to rank using the HARM model. However, areas used for spreading prior to 1976 should be reviewed by the Base Bioenvironmental Engineer and a determination made as to whether the sludge used contained chromic acid waste.

V. CONCLUSIONS

The goal of the IRP Phase I is to identify sites where there is the potential for environmental contamination resulting from past waste disposal practices and to assess the probability of contaminant migration from these sites. The conclusions given below are based on the assessment of information collected from the project team's field inspection, review of records and files, review of the environmental setting, and interviews with base personnel, past employees and regional, state, and local government officials. A listing of all interviewees and outside agency contacts is provided in Appendix B.

Table V-1 is a ranking of the potential contamination sites identified at Reese AFB by their final HARM scores. A summary of HARM subscores for those sites is also provided. The meteorology, geology and population characteristics for most of the sites are very similar, so some effort was made to emphasize the differences between the sites. In addition, many of the data are somewhat speculative, being primarily based on interviews and worst case scenarios.

Receptor scores ranged from 44.4 to 63.3. The two lakes and the adjacent landfills had the highest scores. They were nearest the center of the base and attendant living areas. Also, a golf course has been constructed over most of this area, attracting potential receptors.

Waste characteristic scores ranged from 30 to 100. The potential for plating wastes (metals) and most oily wastes contributed to the range. The presence of liquid wastes also contributed to the high values.

Pathway scores ranged from 38.9 to 100. The relatively low permeability soils, a deep aquifer and little evidence of migration of wastes created low scores. The highest score was due to Avgas detected in Well #4 after the aquasystem spill.

TABLE V-1. SUMMARY OF HARM SCORES FOR THE RATED SITES, REESE AFB, TEXAS

Site #	Site Description	Rank	Receptor Score	Waste Characteristic Score	Pathway Score	Raw Score	Final Score
SI-1	Industrial Lake	1	57.8	100	80	79.3	75.3
SI-2	Sewage Lake	2	57.8	80	80	77.5	68.9
D-4	Landfill north of Sewage Lake	3	57.7	80	66.7	68.1	68.1
SP-1	Aqua System Spill	4	54.4	60	100	71.5	67.9
D-1	Southwest Landfill	5	48.3	80	57.8	60.0	60.0
SI-4	CE Paint Shop, French Drain	6	54.4	60	53.7	56.0	56.0
FT-1	Active Base Fire Training Area	7	44.4	72	46.3	54.2	54.2
D-5	Landfill west of Sewage Lake	8	63.3	30	66.7	53.3	53.3
D-11	Northwest Landfill	9	44.4	50	38.9	44.4	44.4

The two lakes have natural clayey substrates (if still intact after dredging). The Industrial Lake has a valve and pump to decrease spread of contamination. The aquasystem spill received evaporative treatment before backfilling. These management techniques (natural and man-made) created a difference between the raw and final scores.

In summary, most of the receptor and pathway scores are low, due to the flat land, arid environment and agricultural land use. The two lakes ranked highest, since alleged contamination already exists in surface water. The two largest landfills ranked the next highest, since they had the largest volumes of waste. The aquasystem spill rated high because migration of Avgas into well 4 in 1949 is documented. The rest of the sites had lower final scores, primarily due to small waste volumes and low population densities.

First-hand evidence of environmental contamination (visual observations or odor) was noted only at Site SI-1, the Industrial Waste Lake (highest HARM score) and the active fire training area (FT-1). The Industrial Waste Lake was rated using the HARM model because of the well documented historical use of this lake to dispose of hazardous waste streams and the potential for off-site contaminant migration via flooding prior to 1977. Since 1977, interconnection of the Industrial Lake with the Sewage Lake/golf course irrigation system introduces a secondary potential pathway for contaminant migration. The HARM score for this site is 75.

Although the Sewage Lake (SI-2) received the second highest HARM score (68) based on potential for environmental contamination, existing analysis of the surface water and sewage sludge are generally typical of sewage lagoons. Polynuclear aromatic hydrocarbons were detected in minor quantities.

The hazard associated with the aquasystem spill may actually be lower than the HARM rating implies. Although it was a significant spill, due to the length of time since the Avgas spill occurred and the remedial actions implemented at the time of discovery, the probability of this site being a continuing source of contamination is low. In addition, the contamination would be so diffuse within the ground-water system that concentrations in samples would be below detection limits. A method of detection would be difficult to identify.

VI. RECOMMENDATIONS

The final HARM scores of each of the nine rated sites (a total of 36 sites were screened) were compared and a relative scale of potential risk was developed (Table VI-1). Of greatest concern are high risk potential sites SI-1 and D-4. Recommendations for Phase II activities at these sites are provided in Section VI A-1.

Based on the conclusions stated in Section V, Sites SP-1 (aquasystem spill) and SI-2 (Sewage Lake) have been re-evaluated and considered to pose a low risk of environmental impairment. No Phase II activities are recommended at this time.

Sites receiving a moderate potential risk rating are the Southwest Landfill (D-1) and the CE Paint Shop trench (SI-4). Suggested limited Phase II investigations are described for these sites in Section VI A-2.

The remaining three rated sites (FT-1, D-5 and D-11) are considered to have a low potential risk. On the basis of data currently available, no further actions are recommended.

Although the remaining 27 nonrated sites were determined to not require further study in their present conditions, they still represent potential environmental concerns. And, they should be evaluated for environmental impact prior to any activities which might cause disruption.

A. Recommended Phase II Activities

A stepwise approach has been taken in recommending Phase II activities. This approach provides the most cost-effective means of determining whether environmental contamination from past disposal activities has occurred, and if so, the extent of the impact.

TABLE VI-1. POTENTIAL RISK RANKING BASED ON FINAL HARM SCORES

Site #	Description	Final HARM Score	Potential Risk
SI-1	Industrial Waste Lake	75.3	High
SI-2	Sewage Lake	68.9	
D-4	Landfill, north of Sewage Lake	68.1	
SP-1	Spill, POL Storage Area (Aquasystem)	67.9	
D-1	Southwest Landfill	60.0	Moderate
SI-4	CE Paint Shop trench	56.0	
FT-1	Active Fire Training Area (Reese)	54.2	Low
D-5	Landfill, west of Sewage Lake	53.3	
D-11	Northwest Landfill/Rubble Area	44.4	
FT-6	Active Fire Training Area (Terry County)	40.4	

1. Phase II Activities for High Potential Risk Sites

a. Site SI-1 Industrial Waste Lake (HARM Score = 75)

Due to the nature of the substrate underlying the Industrial Lake and composing the playa bed in which it is located, it is doubtful that impounded wastes have migrated to the Ogallala aquifer, some 150+ ft. below the land surface. However, periodic flooding prior to installation of an overflow pump in 1977 may have resulted in off-site migration with resultant soils contamination.

As a preliminary step to determine if contamination has occurred, three suggested soil sampling locations (2 within the base and a third off-base if possible) are shown on Figure VI-1 (Step 1). Soil samples could be obtained by hand augering to 10 ft., with samples taken at 2.5 ft. intervals. Considering the nature of wastes disposed at this site, it is recommended that samples be analyzed for oil and grease, Pb, Cr, and Cd, and volatile organic halocarbons (EPA Method 602).

An expanded soil sampling program (Step 2) designed to determine the areal extent of contamination should be undertaken only if results from the first round of sampling are positive. Four additional locations are shown on Figure VI-1. These samples should be obtained and analyzed as described above.

If contaminant migration has extended to the second phase sites, the possibility of ground-water contamination becomes more likely. In this scenario, it is recommended that a single ground-water well be emplaced along the edge of the Industrial Lake and that water from the Ogallala Aquifer be sampled for the parameters described previously.

If ground-water contamination is found to have occurred at the Industrial Lake, the Sewage Lake (Site SI-2) should be re-evaluated for its potential risk in view of the new data.

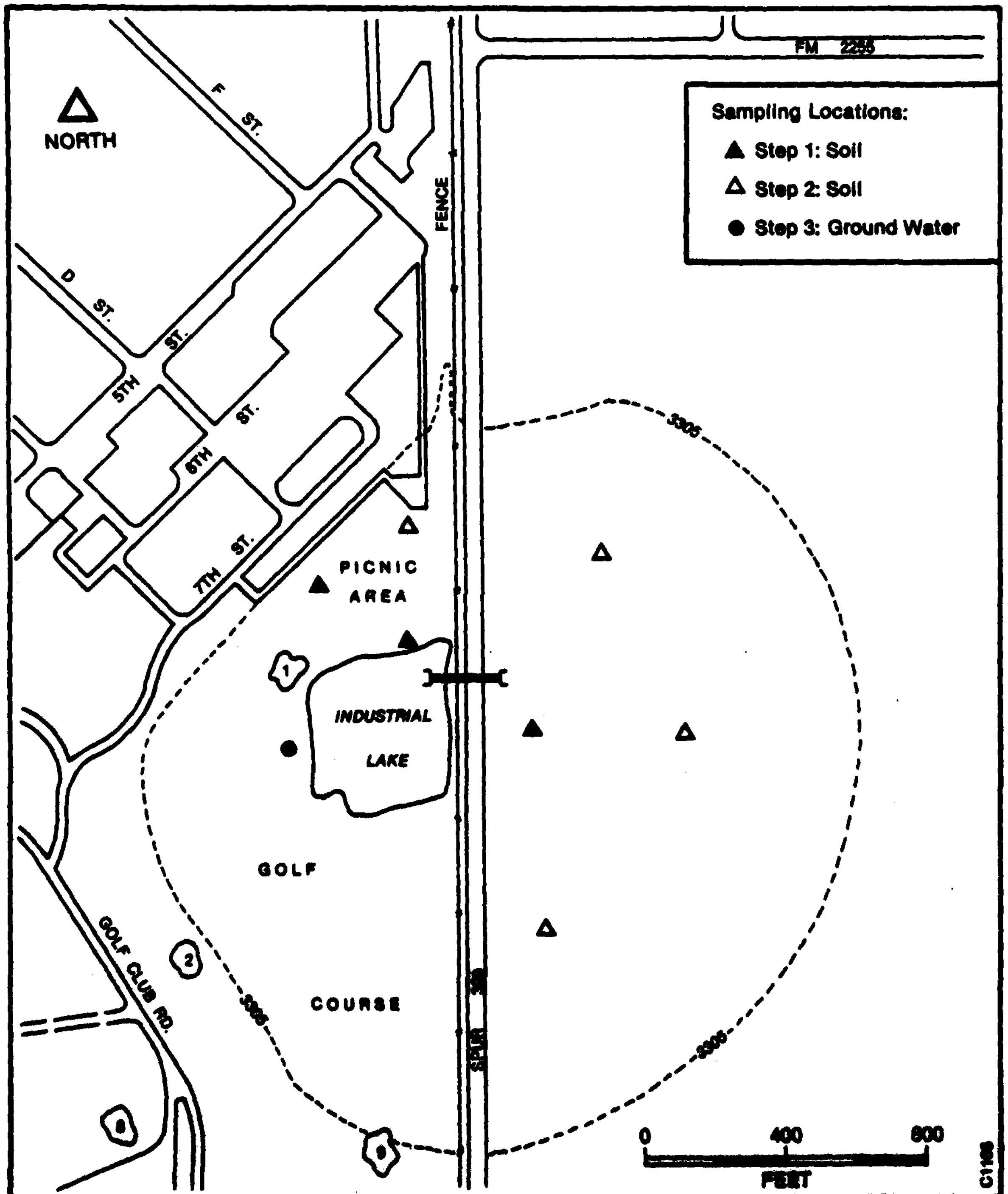

Figure VI-1. Recommended Phase II Sampling Locations, Site SI-1, Industrial Waste Lake, Reese AFB, Texas.

b. Site D-4 Landfill North of Sewage Playa (HARM Score = 68.1)

If contamination exists, it is probably migrating toward the playa. For this reason several hand augered soil and soil moisture sampling sites are located, as shown in Figure VI-2. Sampling is to be accomplished as described previously. A full GC/MS (EPA 624 and 625) and metals (IPC) scan of collected materials, composited by hole, should be accomplished. If further sampling is required, specific indicator parameters are to be chosen for the analyses.

Full determination of the areal extent of contamination is to be accomplished by this recommended program. Further hand augering and sampling by depth should be completed (splitting original samples, compositing half and holding the remainder is effective) in order to assess vertical migration of contaminants. If analyses of samples suggest the possibility that contaminants have migrated vertically to the water table, drilling to the aquifer to assess the contaminant plume may be required.

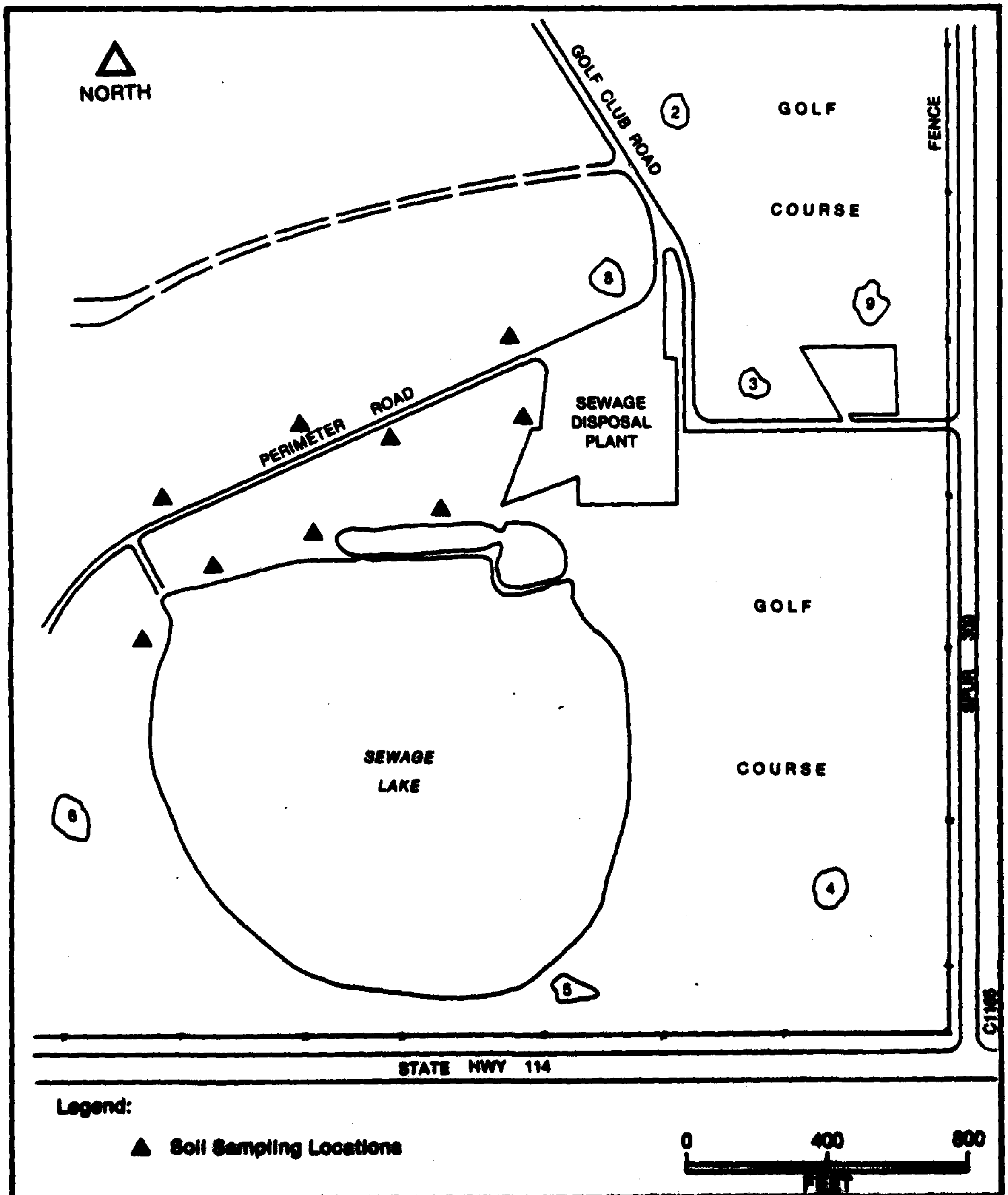

Figure VI-2. Recommended Phase II Sampling Locations, Site D-4, Landfill North of the Sewage Lake, Reese AFB, Texas.

2. Limited Phase II Activities for Moderate Potential Risk Sites

a. Site SI-4 CE Paint Shop Trench (HARM Score = 56.0)

The precise location of the trench has not been determined. Theoretically, a detailed resistivity study over the general area could be used to locate concentrations of conductive solvents. However, the small size of the area and residual volumes in question do not favor this method. A grid array of 5 or 6 soil sampling sites should be established. (See description of Step 1 soil sampling program at Site SI-1). If a trench location can be established, hand augering two holes to sample materials below the gravel is recommended. GC/MS analysis for volatiles (EPA 624) should be utilized to identify and quantify contamination.

b. Site D-1 Southwest Landfill (HARM Score = 60)

A limited Phase II soil sampling program is recommended to determine if environmental contamination has resulted from this moderate risk site. A preliminary round of soil samples is recommended to be obtained by hand augering at the four locations identified in Figure VI-3. Soils should be sampled to a depth of 15 feet at 2.5 ft. intervals. Since the natural soils in this area are known to be among the most permeable on the base, undisturbed samples should be obtained, if possible, and tested for physical as well as chemical parameters. Recommended analyses include porosity, permeability, pesticides, cadmium, chromium, lead, and volatile organic halocarbons (EPA Method 602). Depending on the results of these preliminary analyses emplacement of a single ground-water well may be advisable near the most highly contaminated soil sampling site to assess potential ground-water contamination.

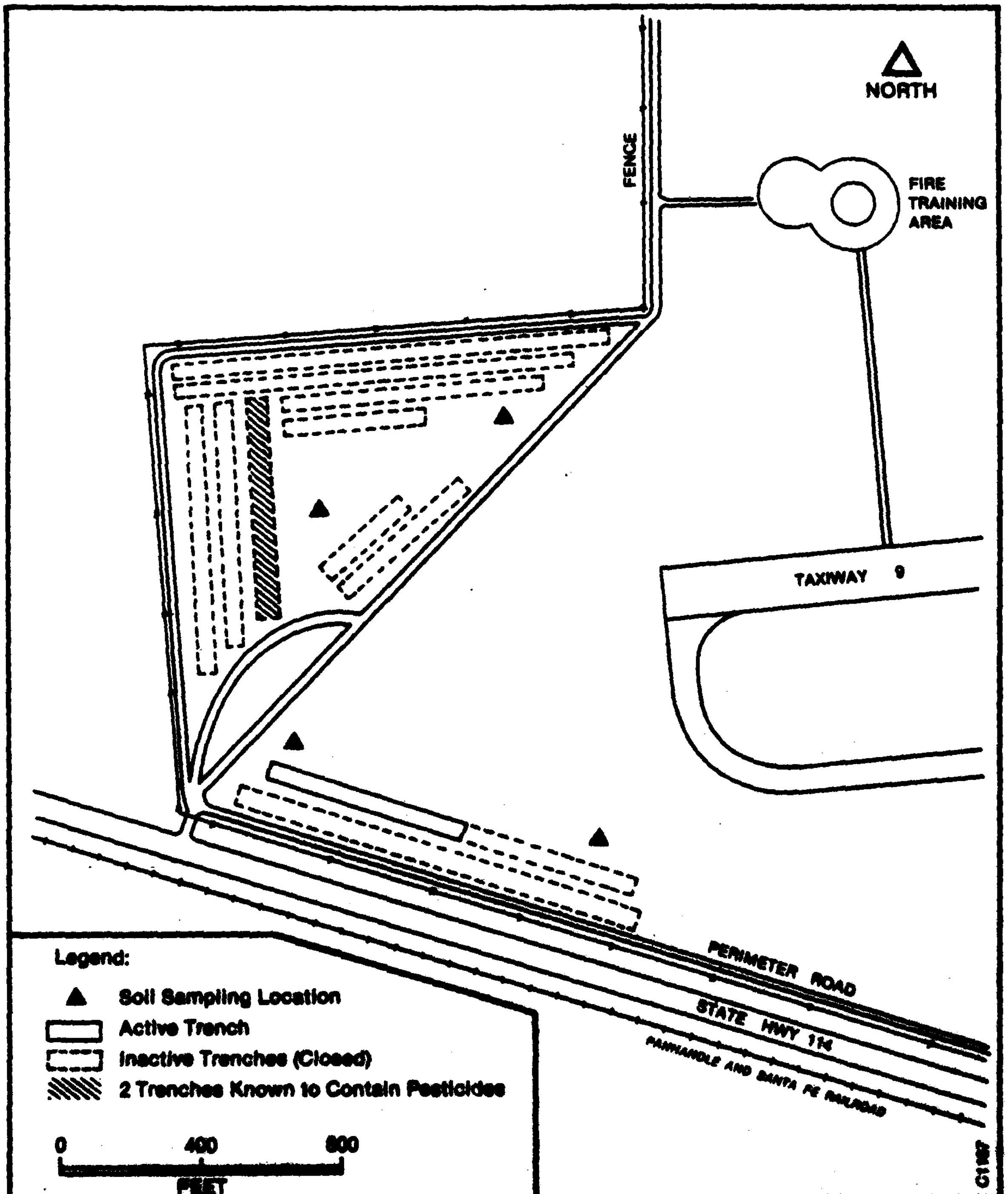

Figure VI-3. Recommended Limited Phase II Sampling Locations, Site D-1, Southwest Landfill, Reese AFB, Texas.

3. Sewage Digester Sludge Spreading Areas

The areas on the base where sewage digester sludge has been spread to fertilize grassy areas are too dispersed and poorly defined to rank using the HARM model. As stated in Section IV, a potential concern associated with the sludge is the possible addition of chromic acid as a procedure used for waste acid disposal prior to 1976 (USAF memo dated 30 April 1976). Areas which were spread with the sludge prior to 1976 should be evaluated to determine if the sludge contained chromic acid waste.

APPENDIX A

Resumes of Key Project Personnel for the Phase I, Reese AFB

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FRED B. BLOOD

EDUCATION:

M.S., Biology (Aquatic Ecology), Virginia Commonwealth University, 1973.

B.S., General Science (Biology and Chemistry), Virginia Polytechnic Institute, 1969.

EXPERIENCE:

Biologist, Radian Corporation, 1981-Present.

Senior Consultant, Seagull Environmental Control, 1980-1981.

Technical Field Advisor, U.S. EPA Region V, Law Engineering Contract, 1979.

Aquatic Ecologist, Law Engineering Testing Co., 1976-1979.

Staff Biologist, Virginia Electric and Power Co., 1973-1976.

Visiting Scholar, Smithsonian Institute, 1973.

Teaching Assistant, Virginia Commonwealth University, 1971-1973.

Teacher, Henrico County (Virginia) Public Schools, 1969-1971.

FIELDS OF EXPERIENCE:

At Radian, Mr. Blood is responsible for managing the collection, identification, and interpretation of ecological data. His particular area of expertise involves aquatic ecology and environmental toxicology. The following project experience demonstrates his expertise.

Mr. Blood is a task leader to evaluate mining applications for OSM. In this capacity Apparent Completeness Reviews (ACR) and Technical Analyses (TA) are being accomplished. Important issues include highwalls, large raptors, and prey abundance in relation to reclamation plans.

Mr. Blood has also visited several non-ferrous industries to provide environmental assessments in relation to U.S. EPA's Effluent Guidelines development and/or to provide input to Environmental Impairment Liability insurance programs.

Mr. Blood was Project Director on a subcontract for the Cummins Creek lignite project. Collection of aquatic ecological data, including analyses of fish, and plankton data was performed. The study was expanded to include 20 stations including rivers, streams, cattle tanks, and SCS reservoirs.

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Fred B. Blood

As a task director, Mr. Blood was involved in assessing potential environmental impacts from proposed mitigation procedures at a hazardous waste site in Southern California. This task involved evaluation of ground water, air quality, and transportation for the redisposal of 200,000 yd^3 of hazardous material.

As a task director, Mr. Blood was responsible for evaluating an urban lake below an uncontrolled hazardous waste site (U.S. EPA Superfund Site). This project involves the collection of biotic, water, and sediment samples. Extensive organic and metal analyses have been accomplished to document existing conditions and derive a monitoring program for the future. A cost-effective monitoring program based on empirical data and environmental fate modeling was proposed.

Mr. Blood was Project Director of a study concerning six uranium mine reclamation ponds in Southeast Texas. This study involved the quantification of physico-chemical data, periphyton, fish, macrophytes, phytoplankton, zooplankton, and aquatic macrophytes. Also included are limited chemical analyses of the water column and detailed trace metal and radionuclide determinations of water, sediments, and various aquatic biotic food chains. The evaluation included insights into the relative success and failure of reclamation processes.

As an Ecology Task Leader, Mr. Blood was responsible for input into an environmental assessment for a lignite gasification plant located in Northeast Texas. This study includes all the standard terrestrial and aquatic studies including wetlands, vegetative mapping, wildlife, and aquatic environments.

Mr. Blood has also been involved with environmental studies associated with a synfuels plant on the Ohio River Floodplain in Kentucky. Responsibilities included analyses of endangered and protected species, wetlands, fisheries, macroinvertebrates, and plankton. A NEPA-responsive study was accomplished. He also provided input into three other lignite projects, either at an ecological resources or aquatic resources level. These inputs were primarily concerned with "fatal flaw" or other siting programs.

While with Radian, Mr. Blood has provided asbestos inspection services to a large State hospital in Ohio, air monitoring consultation to many industries throughout Texas, and helped with the training of laborers in several states. This last process provided the attendees of the Northern California Laborers Training Center with official certification by CAL-OSHA as asbestos workers and started a process where the State may require more stringent respiratory protection of asbestos workers. Mr. Blood has also participated in writing/reviewing specifications, air monitoring, and quality control for asbestos removal contracts throughout the U.S.

Fred B. Blood

As Senior Consultant for the Seagull Environmental Company, Mr. Blood had a variety of responsibilities. Many buildings and structures were inspected and evaluated by Mr. Blood, including work for various school districts, universities, and private industry. Mr. Blood made presentations on asbestos-related problems at seminars and meetings sponsored by state and local environmental health associations in Ohio and Illinois. He oversaw the training of asbestos workers at numerous projects in states ranging from Illinois and Florida to New Hampshire.

Mr. Blood served as Technical Field Advisor to the U.S. EPA asbestos-in-schools program for Region V (Chicago). In this capacity he made over 60 presentations to 2,500 people across the six-state region. He inspected and evaluated more than 100 schools and provided advice to numerous contractors and analytical laboratories in becoming involved in asbestos abatement activities.

As an Aquatic Biologist with Law Engineering Testing Company, Mr. Blood was Project Director for a baseline aquatic survey for a paper mill in the Oconee River, near Dublin, Georgia. The study included physico-chemical data, fisheries, periphyton, and macrobenthos collected at seven stations during four seasons.

Mr. Blood was co-director for a water quality management study for the Corps of Engineers. The study involved two one-year studies of two reservoirs (Carters Lake and Lake Allatoona) in Georgia. These studies involved twice seasonal collections at over 15 stations on both reservoirs. Data collected included: physico-chemical profiles, nutrients, trace metals, and organic pesticides in the water column; fisheries; macrobenthos; zooplankton; periphyton; Hester-Dendy substrates; algal growth potential; and trace metal and organic pollutants in various portions of the aquatic food chain. All data underwent rigorous QA/QC audits and were coded into the U.S. EPA STORET data base.

As a biologist for Virginia Electric and Power Company, Mr. Blood was responsible for biological analyses of aquatic environments associated with nine operational sites and two site screening studies. The operation studies included six estuarine and three freshwater sites. Mr. Blood studied thermal and velocity discharge effects on macroinvertebrate and fish communities. He also evaluated impingement and entrainment. Two sites, one estuarine and one freshwater, included nuclear power stations and Mr. Blood supervised collections for radionuclide studies.

In the summer and fall following graduate school, Mr. Blood was co-holder of a visiting scholar fellowship to study the freshwater clams (Unionidae) of Virginia. He also attended a biological field camp sponsored by the University of Montana on Flathead Lake, Montana. While in Montana, he studied trophic states in two pot-hole lakes, snow algae, and physical geology.

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Fred B. Blood

As a graduate student, Mr. Blood was involved in various studies, including: intensive catfish culture, primary productivity (conventional and as C^{14}); fishery surveys, acid mine drainage, post-impoundment surveys, and his thesis on freshwater clams.

While teaching general, earth, and biological sciences to eighth and ninth graders, Mr. Blood participated in summer research projects. These studies involved pre-impoundment surveys for a large recreational reservoir to be utilized by a nuclear power plant and acid-mine recovery studies.

HONORARY AND PROFESSIONAL SOCIETIES:

Society of Environmental Toxicology and Chemistry, American Fisheries Society (Certified Fisheries Scientist), Ecological Society of America, Sport Fishing Institute.

PUBLICATIONS:

"Environmental Assessment of the Remedial Action Alternatives for the McColl Site," Fullerton, CA, (Radian Report) 1983.

"Direct Utilization of Geothermal Energy for Space and Water Heating at Marlin, Texas" (Radian and DOE/ET 27059-1), 1983.

"Reclamation Impoundment Study: An Analysis of Aquatic Habitats Created in the Reclamation of Uranium Surface Mines in South Central Texas," (Radian Report) 1983.

"Development of a Monitoring Program to Evaluate the Effect of Remedial Actions at the Lipari Landfill on Alcyon Lake, Pitman, New Jersey," (Radian Report) 1983.

Ecology - in "Environmental Consideration and Air Quality Modeling for the Edgewood and Mustang Creek Prospects and Associated Energy Park," (Radian Report) 1981.

Aquatic Resources Chapter - in "Preliminary Environmental Analysis Report for Coal Gasification Plant, Henderson, Kentucky," (Radian Report) 1981.

"Oconee River Biological Baseline Evaluation," (Law Engineering Report) 1980.

"Contract Report - A Water Quality Management Study of Carters Lake, GA," (Law Engineering Report) 1980.

"Contract Report - A Water Quality Management Study of Lake Allatoona, GA," (Law Engineering Report) 1980.

Fred B. Blood

"A 316(b) Study of the Lansing Smith Steam Plant," prepared for Gulf Power Company (Law Engineering Report).

"A Preliminary Comparison of Two Oxidation Ponds with Different Trophic States in Central Virginia," co-authored with J. Reed and G. Samsel, Va. J. Science, 23 (2), 1973.

"A Laboratory Heated Raceway for Studying the Biology of Channel Catfish (Ictalurus punctatus)," co-authored with J. Reed and G. Samsel, Progressive Fish Culturist, 35 (1), 1973.

"A Check List of Unionid Fauna (Mollusca:Bivalvia) in the Pamunkey River System, Virginia," co-authored with M. Riddick, Nautilus, 88 (2), 1973.

PROFESSIONAL PRESENTATIONS:

"Investigation of Nutrient Factors Limiting Phytoplankton Productivity in Two Central Virginia Ponds" (with J. Reed, G. Samsel, and M. Winfrey), Annual Meeting, Association of Southeastern Biologists, Mobile, AL, 1972.

"Preliminary Comparison of Two Oxidation Ponds with Different Trophic States in Central Virginia," (with J. Reed, G. Samsel, and H. Winfrey), Annual Meeting, Association of Southeastern Biologists, Mobile, AL, 1972.

"Unionidae (Mollusca) of the Pamunkey River, Virginia" (with M. Riddick and J. Reed), Annual Meeting, Association of Southeastern Biologists, Savannah, GA, 1974.

"An Effects Assessment of Impingement at the Lansing Smith Steam Plant" (with R.A. Garrett), Annual Meeting, Association of Southeastern Biologists, Tuscaloosa, AL, 1978.

"Strategies of Collecting Macro-invertebrates," Annual Meeting, Georgia Fisheries Workers Association, Rome, GA, 1978.

"Asbestos in Schools, Its Evaluation, Its Solutions," 65 locations throughout six states (MI, IL, OH, IN, MN, WI), 1979.

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KATHEY A. FERLAND

EDUCATION:

M.A., Regional Planning, University of North Carolina, Chapel Hill, NC, 1983.

B.A., English, University of Texas, Austin, TX, 1976.

EXPERIENCE:

Staff Socioeconomist, Radian Corporation, Austin, TX, 1983-Present.

Survey Coordinator, Center for Health Services, Nashville, TN, 1982.

Research Assistant, Department of City and Regional Planning, Chapel Hill, NC, 1981-1982.

Grants Administrator, American Insititute for Learning, Austin, TX, 1978-1981.

FIELDS OF EXPERIENCE:

Ms. Ferland is in the Policy Analysis Division of Radian Corporation. Her fields of expertise are resource economics, energy policy analysis, socioeconomic impact evaluation, and water resources. While at Radian, Ms. Ferland has participated in projects concerning energy and commodity price forecasts, socioeconomic impact evaluation, and environmental regulations and permitting at hazardous waste sites.

Ms. Ferland was Leader of the commodity and energy price forecasting task for an economic and technical feasibility study of electricity generation technologies for the Air Force. On this project, she reviewed several national energy supply and demand models and regionalized price forecasts to the southern California market. These forecasts served as the basis for industrial gas price projections. At Radian, Ms. Ferland has also participated in several projects related to hazardous waste. One involved assessing the supply and demand for technologies which degrade dioxins. In another study, she assessed research needs in the national hazardous waste site cleanup program.

Ms. Ferland has also conducted policy and project studies for local and state governments and academic departments in the areas of water resources and hazardous waste disposal. These studies include: an evaluation of the impact of industrial location decisions on water supply and effluent treatment capacities; a projection of the impacts of watershed development on phosphorous concentration in High Point Lake, North Carolina; an analysis of the use of utility extension policy as a growth management tool; and evaluation of the technical and financial options for controlling inactive hazardous waste sites in North Carolina.

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Kathey A. Ferland

Her thesis, "Cost-Benefit Analysis and Environmental Standard Setting: A Case Study of the Implementation of Executive Order 12291," examines the use of economic analysis in the setting of water pollution control guidelines. This paper also analyzes the legal and organizational background influencing the standard setting process for the steel industry BAT and BPT guidelines and evaluates the environmental modeling component of EPA's cost-benefit analysis.

Ms. Ferland coordinated a survey to over 1200 people in rural Kentucky to ascertain the health effects of contaminated drinking water. She has experience in the initiation, design, implementation, and analysis of surveys.

Ms. Ferland performed administrative and management functions at the American Institute for Learning, a not-for-profit educational institute. As a Grants Administrator, she was responsible for all aspects of grants management, proposal and budget preparation, and reporting.

PROFESSIONAL SOCIETIES:

American Planning Association.

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PETER F. ELLIS II

EDUCATION:

B.S., Chemistry, Southwest Texas State University at San Marcos, TX, 1977.

EXPERIENCE:

Staff Scientist, Radian Corporation, Austin, Texas, 1977-Present.

Technician, Radian Corporation, Austin, Texas, July-August 1976.

Lab Assistant, Texas State Department of Health, Austin, Texas, 1972-1975.

FIELDS OF EXPERIENCE:

Since coming to Radian in 1977, Mr. Ellis has been involved full time in high and low temperature aqueous corrosion research. He is Radian's resident specialist in the electrochemical aspects of corrosion of many alloy systems, including steels and stainless steels, as well as aluminum-, cobalt-, copper-, nickel-, titanium-, and zirconium-based alloys, in a wide variety of dilute and concentrated aqueous salt solutions containing dissolved corrosive gases such as sulfur oxides, hydrogen sulfide, carbon dioxide, and oxygen.

In the field of Flue Gas Desulfurization (FGD) materials technology, Mr. Ellis is data analysis task leader for an ongoing FGD system component failure analysis project. This project's goal is determination of root-cause-of-failure of FGD system components. As task leader, Mr. Ellis has directed the field investigation and subsequent laboratory analysis of numerous FGD system component failures including metal structural elements, linings, and slurry handling equipment. He is serving or has served as an FGD system materials consultant to a number of utilities, including Colorado-Ute Electrical Association, Minnkota Power Cooperative, Monogahela Power, Potomac Electric Power Company, New York State Gas and Electric Corporation, Texas Utilities Generating Company, and West Penn Power Company.

In the geothermal materials technology field, Mr. Ellis's primary responsibility is Project Manager for the Geothermal Materials Analysis Project. As such, he has responsibility for the technical adequacy of this project which provides geothermal corrosion engineering support to DOE geothermal energy projects, provides geothermal component failure analysis, and has produced a Corrosion Reference for Geothermal Downhole Materials Selection book. Under this project, Mr. Ellis was responsible for failure analyses of components from numerous geothermal power systems including the Cerro Prieto Power Station, Mexico; The Geysers Power Station, CA; the LBL-500 KW Direct Contact Binary Generator, East Mesa, CA; the Magma Power Corporation 10MW Binary Generator, East Mesa, CA; the Raft River 5MW Binary Generator, ID; the Larderello Power Station, Italy; and the Hot Dry Rock Project at Fenton Hill,

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Peter F. Ellis II

NM. Failure analyses of components from direct utilization systems in California, Colorado, Montana, Nevada, and Oregon have also been performed.

Previously, Mr. Ellis was principal investigator for the development of Material Selection Guidelines for Geothermal Energy Utilization Systems, a project sponsored by the United States Department of Energy. In the course of this investigation, Mr. Ellis and/or his coworkers studied first-hand the corrosion problems encountered at geothermal power plants in Japan, Iceland, Italy, Mexico, El Salvador, and New Zealand, as well as in the United States. Direct applications of geothermal energy in New Zealand, Iceland, and the United States were also investigated.

Mr. Ellis was also Project Director for a recently completed "Downwell Pump Reliability" study which assessed the state-of-the-art of high-temperature downwell geothermal production pumps.

Mr. Ellis serves as a geothermal materials and corrosion engineering consultant of international reputation. He has provided geothermal corrosion engineering support to the Klamath Falls District Heating Project, OR; the Susanville Geothermal District Heating Project, CA; the Raft River 5MW Binary Generator Project, ID; the Arkansas Power and Light 100 KW Direct Contact Binary Generator Project, AR; the Baca 50 MW Generator Project, NM; the SDG and E 50MW Binary Generator Project at Heber, CA; the HPG-A 3MW Wellhead Generator Project, Puna, HW; and other (privately-owned) projects.

Aside from his primary responsibilities, Mr. Ellis supplies corrosion engineering support as required to other Radian projects. This activity has included material testing and selection for two geothermal direct utilization projects in Texas, as well as material testing and corrosion engineering in flue-gas desulfurization plants, and corrosion assessments of hazardous waste handling systems.

Mr. Ellis is or has been an active participant in a number of committees and advisory bodies concerned with materials and corrosion. These bodies include the National Academy of Science Materials Advisory Board, the Centers for Analysis of Thermal/Mechanical Energy Conversion (CAT/MEC), the National Association of Corrosion Engineers (NACE) Committees T-2E and T-5F, the American Society for Testing and Materials (ASTM) Committee E.45.40, the Industrial Advisory Board on Geothermal Well Casing and Drill Pipe, and the Advisory Board on Downhole Pump Bearings.

In April 1981, Mr. Ellis chaired the Symposium on Corrosion and Scaling at the First Sino/U.S. Geothermal Resources Conference, Tianjin, China.

While on temporary assignment to Radian's Ambient Air Monitoring Department, Mr. Ellis developed a noncomputational method for rapid on-site evaluation of High Volume Air Sampler calibration data; significantly increasing data capture.

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Mr. Ellis' initial work at Radian was on the pilot plant phase of the electrochemical regeneration stage of a proprietary pollution control system. Mr. Ellis made significant input into experiment and component design.

Prior to joining Radian, Mr. Ellis was employed by the Texas Department of Health, where he worked on the development of TSDH Transport, a special growth medium for isolation and identification of N. gonorrhoeae, the causitive agent of gonorrhea. On this project, Mr. Ellis studied the selectivity and specificity of the TSDH Transport and was responsible for quality control of 50,000 units/month of this product.

PROFESSIONAL AND TECHNICAL MEMBERSHIPS AND ASSOCIATIONS:

American Society for Testing and Materials (ASTM), National Association of Corrosion Engineers (NACE), Geothermal Resources Council (GRC).

PRINCIPAL PUBLICATIONS:

Ellis, P.F., Review of Shell-and-Tube Heat Exchanger Fouling and Corrosion in Geothermal Power Plant Service, DOE Contract DE-AC03-81SF11503; NTIS Pub Code DOE/SF/11503-2, Radian Corporation, Austin, TX, December 1983.

Ellis, P.F. and H.J. Williamson, State-of-the-Art Assessment of Geothermal Downwell Pump Reliability, EPRI Project No. RP1195-8, Radian Corporation, Austin, TX, May 1983 (manuscript accepted August 1983).

Smith, C.S. and P.F. Ellis (P.I.), Addendum to Materials Selection Guidelines for Geothermal Energy Utilization/Systems, DOE Contract DE-AC02-79ET27026 and DE-AC03-81SF11503, NTIS Pub Code DOE/RA/27026-2, Radian Corporation, Austin, TX, May 1983.

Ellis, P.F., C.C. Smith, R.C. Keeney, D.K. Kirk, and M.F. Conover, Corrosion Reference for Geothermal Downhole Materials Selection, DOE Contract DE-AC03-81SF11503, NTIS Pub Code DOE/SF/1503-1, Radian Corporation, Austin, TX, March 1983.

Ellis, P.F. and M.F. Conover, Materials Selection Guidelines for Geothermal Energy Utilization Systems, DOE Contract No. DE-AC02-79ET27026, NTIS Pub Code DOE/RA/27026-1, Radian Corporation, Austin, TX, 1981.

DeBerry, D.W., P.F. Ellis, and C.C. Thomas, Materials Selection Guideilnes for Geothermal Power Systems, First Ed., DOE Contract No. EG-77-C-04-3904, NTIS Pub Code ALO-3904-1, Radian Corporation, Austin, TX, 1978.

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Peter F. Ellis II

PAPERS:

Ellis, P.F. and T.F. Green, "State-of-the-Art Assessment of Geothermal Downwell Pump Reliability," presented at EPRI's Seventh Annual Geothermal Conference and Workshop, San Diego, CA, 28-30 June 1983.

Ellis, P.F., "Shutdown Corrosion in Geothermal Energy Systems," Geothermal Engineering and Materials (GEM) Program Experience, San Diego, CA, 6-8 October 1982.

Ellis, P.F., "Critical Assessment of Carbon Steel Corrosion in Low Temperature Geothermal Applications," Paper No. 74 presented at Corrosion/82, Houston, TX, 22-26 March 1982.

Ellis, P.F., "A Geothermal Corrosivity Classification System," Geothermal Resource Council Transactions, Vol. 5, GRC, Davis, CA, October 1981.

Ellis, P.F., "Current U.S. Corrosion Engineering Technology and Its Relevance to Geothermal Heating Systems of the Peoples Republic of China," Proceedings: First Sino/US Geothermal Resources Conference (Tianjin, Peoples Republic of China), Oregon Institute of Technology, Klamath Falls, OR, April 1981.

Ellis, P.F. and D.M. Anliker, "Geothermal Power Plant Corrosion Experience - A Global Survey," Materials Performance, Vol. 21, No. 2, February 1982.

Ellis, P.F. and M.F. Conover, "Corrosion Engineering for Geothermal Heating Systems," Special Report No. 9: Commercial Uses of Geothermal Heat, Geothermal Resources Council, Davis, CA, June 1980.

Ellis, P.F., "Failure Analysis of Conventional Heating System Components in Geothermal Direct Utilization Service," Paper No. 207 presented at Corrosion/80, Chicago, IL, March 1980.

Ellis, P.F. and M.F. Conover, "Materials (Alloys) Selection for High Temperature Downhole Instrumentation," High Temperature Electronics and Instrumentation Seminar Proceedings, December 3-4, 1979, Publication Code SAND80-0834C, Sandia Laboratories, Albuquerque, NM, May 1980.

Conover, M.F., P.F. Ellis, and D.A. Mitchell, "Premature Failure of Residential Geothermal Heating System Fan Coil Units," Paper No. 274 presented at Electrochemical Society Fall Meeting, Los Angeles, CA, 14-19 October 1979.

In addition to the above published papers, Mr. Ellis has authored or supervised the production of reports of failure analysis of more than 50 separate components.

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JAMES L. MACHIN, P.E.

EDUCATION:

M.S., Environmental Health Engineering, Civil Engineering Department, University of Texas at Austin, 1980.

M.B.A., University of Michigan, Ann Arbor, MI, 1974.

B.S.E., Engineering, Princeton University, Princeton, NJ, 1971.

EXPERIENCE:

Staff Engineer, Radian Corporation, Austin, TX, 1977-Present.

Hydrologist, Texas Department of Water Resources, Austin, TX, 1975-1977.

Manufacturing Engineer, Texas Instruments, Inc., Austin, TX, 1974.

Pipestress Analyst, C-E Lummus, G.m.b.H., Wiesbaden, Germany, 1971-1972.

FIELDS OF EXPERIENCE:

Mr. Machin has participated in and directed a variety of investigations at Radian. His work has focused on the areas of solid and hazardous waste management, environmental engineering and waste treatment, and water resources engineering and hydrology.

Mr. Machin was Project Director of a study to develop guidance for closure and remedial action at hazardous waste surface impoundments used in the wood treating industry in Florida. The complex regional combinations of hydrogeology, geology, soils, and surface-water hydrology were analyzed. Based on this analysis, treatment technologies and costs were developed for disposal of liquids, sludge, and contaminated soils in the various regions. Mr. Machin also performed an in-depth analysis of the applicability of biological degradation of these wastes by specialized bacteria.

For a major industrial client, Mr. Machin prepared a permit application including operating procedures for a solid waste disposal landfill. On two other projects, he prepared and costed closure plans for RCRA Part B permits for hazardous waste surface impoundments. He was also involved in the design and costing of remedial actions at a major abandoned hazardous waste disposal landfill in the densely populated Los Angeles area.

He also conducted a laboratory waste treatability evaluation. The project involved remedial measures for a hazardous waste site from which leachate containing chlorinated organics had migrated into the local ground water. For another hazardous waste site, he designed a stream bottom sediment analysis program to define extent and severity of waste migration.

James L. Machin

Mr. Machin performed a special analysis involving the reclamation of an abandoned hazardous waste disposal site for a proposed industrial facility. The waste contained residual, low-level radioactivity. A detailed investigation was made and calculations were performed for estimating the cover requirements to eliminate the potential health hazards of the site. At another hazardous waste site, he prepared a design for a permanent, paved cap. The site contained high levels of PCB surface contamination over a large area.

He was Project Director of a study to design and construct stream gaging stations and conduct a detailed surface-water field data collection program at a proposed surface mining site. He has been Project Director or Surface-Water Task Director for several comprehensive environmental assessments of proposed industrial, mining, and power generation sites in various regions of the country. These studies involved extensive field work and analyses in the areas of hydrology; water quality; design and implementation of water, sediment, and priority pollutant sampling programs; statistical data analysis; impact analysis; and mathematical modeling. He has also been Task Director on three site acceptability studies for proposed Department of Energy coal conversion facilities in Minnesota, Tennessee, and Kentucky. A major portion of these studies involved an analysis of the availability of local surface waters for water supply purposes.

As part of an assessment of the water-quality impacts of disposing of power plant wastes in a surface mine, Mr. Machin performed a special hydrologic study. This was done on a reach of the Yampa River in northwestern Colorado and involved a quantitative analysis of exchanges between the surface-water and ground-water systems.

For EPA, Mr. Machin served as Project Director for an Environmental Impact Statement for a proposed sewer interceptor in North Carolina. He participated in an intensive water quality survey of the affected area which included the municipal water supply. He also performed all engineering calculations and costing analyses for the alternatives under consideration. On another project for EPA, Mr. Machin performed a study evaluating the impacts of developing large-scale energy resources in eight western states. This included an analysis of using large quantities of water for coal, oil shale, uranium, and geothermal energy development.

Mr. Machin's work at the Texas Department of Water Resources was primarily within the areas of engineering and water quality analysis, waste treatment, and economic evaluations. He helped design and manage a water quality investigation for a major water supply reservoir for the City of Houston. Both point and nonpoint sources were significant, and both structural and nonstructural control measures were evaluated. A portion of the study involved a cost-benefit analysis of the effects of water quality alterations.

Upon graduation from Michigan Business School, Mr. Machin was employed by Texas Instrument's Digital Systems Division. He was responsible for control

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of all of the printed circuit boards and metal fabricated parts used in their Austin plant.

While at Lummus, Mr. Machin was involved in planning and design of industrial facilities. He was primarily responsible for computer stress analysis of high and low pressure piping systems.

PROFESSIONAL AFFILIATIONS:

Registered Professional Engineer, Texas No. 53349; American Water Resources Association; Water Pollution Control Federation; Texas Water Pollution Control Association.

HONORS:

1976 EPA Fellowship for Professional Development of an Agency Employee of the State of Texas.

PUBLICATIONS:

Machin, J.L. and D.L. Richmann, "Guidance for Closure and Remedial Action at Hazardous Waste Surface Impoundments--Wood Treatment Industry," Radian Corporation, Austin, TX, January 1984.

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James L. Machin

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Radian Staff, "Environmental Assessment of Air Quality, Surface Water, and Noise Impact for the Proposed Milam Mine," Radian Corporation, Austin, TX, July 1982.

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James L. Machin

Perino, J.V., et al., "Compilation of Environmental Information for a Proposed Olefins Complex, Brazoria County, Texas," Radian Corporation, Austin, TX, July 1981.

Beall, G.D., J.L. Machin, and K.L. Kelly, "Field Measurements of Environmental Impacts of Gypsum Pile Radioactivity," Radian Corporation, Austin, TX, June 1981.

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Machin, J.L. and A.P. Covar, "Floodplain Modeling for Proposed Phillips Olefins Complex, Sweeny, Texas," Radian Corporation, Austin, TX, March 1980.

McCloskey, M.H., et al., "Preliminary Culvert Design, Phillips Olefins Complex, Sweeny, Texas," Radian Corporation, Austin, TX, March 1980.

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James L. Machin

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Sheffield, F.H., J.L. Machin, and T.W. Grimshaw, "Preliminary Evaluation of Hydrology-Related Regulatory Risks for Lignite Mining at the Deadwood-Shiloh Prospect, Panola County, Texas, and DeSoto Parish, Louisiana," Radian Corporation, Austin, TX, February 1979.

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Holland, W.F., et al., "Environmental Impact Statement for the Greensboro Guilford County, North Carolina, 201 Wastewater Treatment System (Draft and Final EIS)," Radian Corporation, Austin, TX, September 1977.

Machin, J.L., "An Estimation of Nutrient Sources to an Impoundment: Lake Livingston on the Trinity River, Texas," Texas Water Quality Board, Austin, TX, June 1976.

RADIAN
CORPORATION

DEBRA L. RICHMANN

EDUCATION:

M.A., Geology, University of Texas at Austin, 1977.

B.A., Geology, University of Minnesota, 1974.

EXPERIENCE:

Staff Geologist, Radian Corporation, Austin, TX, 1981-Present.

Research Scientist Associate II, Bureau of Economic Geology, University of Texas at Austin, 1979-1981.

Technical Research Assistant, American Petroleum Institute, 1976-1979.

Research Assistant, Bureau of Economic Geology, University of Texas at Austin, 1976.

Teaching Assistant, Department of Geological Sciences, University of Texas at Austin, 1974-1976.

FIELDS OF EXPERIENCE:

As a staff geologist at Radian, Ms. Richmann has been involved in a variety of projects requiring geological assessments. During the past two years she has had major involvement in an ongoing EPRI-sponsored program to evaluate limestones as wet scrubbers in flue gas desulfurization (FGD) systems. She was task leader for the chemical and physical analysis, geological survey and sampling, and subset analysis tasks. Selected limestones were described in detail on macroscopic and microscopic scales to relate mineralogical and textural variation to grindability, reactivity, and other parameters of significance to FGD applications. She also served as Project Director for the related FGD Reagent Mapping project.

During the spring and summer of 1983, Ms. Richmann participated in an EPA-sponsored program to obtain process information and collect wastewater samples at non-ferrous metals processing plants. At each of the four plants she visited, representative samples of all wastestreams that are discharged were sampled, split into multiple analytical fractions, preserved as appropriate, and shipped to Radian and other laboratories for analysis. Resulting data are being used to assist EPA in effluent characterization and development of guidelines for each subject industry.

As part of an EPA Region V Superfund study, Ms. Richmann participated in ground-water sampling efforts in the vicinity of an inactive coal-tar distillation and wood preserving facility in St. Louis Park, Minnesota. Sampling locations were selected and samples were collected to determine the type and

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extent of ground-water contamination associated with the uncontrolled release of creosote from the facility.

Field sampling to assess potential ground-water contamination of a shallow aquifer associated with an active waste disposal site in Andover, Minnesota, was also conducted by Ms. Richmann. In addition, wells were tested to determine local hydraulic conductivity of the aquifer. She has also participated in a study to sample and test soils for possible PCB contamination associated with a former industrial site in Greenville, Texas. All appropriate safety precautions were observed in the collection of potentially contaminated samples.

Ms. Richmann has participated in a number of projects evaluating potential geological constraints to proposed lignite mining and utilization facilities in the East Texas Lignite Belt. She was task leader for the topography, geology, and soils and analysis in several recently completed projects in the east and east-central regions of the lignite belt and also participated in a similar investigation of the Sabine Uplift area. These studies, conducted for private industrial clients, are designed to identify gross geology-related conditions that could seriously impede or prohibit development at pre-selected sites. Recommendations arising from these preliminary studies may assist in identification of alternative or preferred sites and in definition of future study requirements. Ms. Richmann has also completed a more detailed follow-up study of site-specific geological conditions related to construction of a lignite gasification facility in Robertson County, Texas for one of these clients.

In a project conducted for the Texas Energy and Natural Resources Advisory Council (TENRAC), Ms. Richmann reviewed and summarized available geologic data from the three geothermal resource regions of Texas: the Gulf Coast geopressured-geothermal, central Texas hydrothermal, and Trans-Pecos hydrothermal provinces. These summaries formed the data base from which she and other Radian team members assessed additional research needs and recommended projects for TENRAC funding considerations.

In a recent project, Ms. Richmann participated in a geothermal resource assessment of a lease within the Coso (California) KGRA. She evaluated test data from exploratory wells and supporting geological literature to make recommendations on sustained economic production feasibility and additional data needs.

Ms. Richmann has participated in three certification testing rounds administered by EPA/RTP for bulk asbestos identification. The EPA-approved method for bulk asbestos identification is polarized light microscopy (PLM). Radian has a perfect record of asbestos identification in this program. Ms. Richmann has analyzed bulk samples for asbestos for a number of school districts and other private clients.

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Ms. Richmann has been involved in the development of data collection instruments for Radian's parent company, Hartford Steam Boiler Insurance and Inspection Company (HSB). These documents are designed to facilitate evaluation of underwriting information from clients seeking Environmental Impairment Liability (EIL) insurance.

Prior to her work at Radian, Ms. Richmann was involved with geopressured geothermal reservoir quality studies at the Bureau of Economic Geology. Her work included detailed petrographic and geochemical investigation of Gulf Coast Tertiary sandstones and development of diagenetic models to predict deep secondary reservoirs suitable for geopressured geothermal energy production. Over 400 thin sections were analyzed during this project. Analytical techniques employed in these studies included transmitted light microscopy, electron microprobe analysis, and scanning electron microscopy.

As a Technical Research Assistant with the American Petroleum Institute, Ms. Richmann's responsibilities included assembling technical data and preparing reports in support of litigation of regulations adversely affecting the petroleum industry. Major areas of investigation included federal regulations governing petroleum exploration and production on Public Lands, and EPA's proposed Criteria and Secondary Standards for ozone and nitrogen oxides.

While working towards her Master's degree in Geology, Ms. Richmann taught the laboratory portion of courses titled Physical Geology (Geo 301) and Igneous Rocks (Geo 416L) at the University of Texas, Department of Geological Sciences. Geo 301 is an introductory level course and Geo 416L is an upper division course in which rock and mineral identification/classification and petrographic techniques are taught.

During her final summer in residence at the University of Texas, Ms. Richmann was employed as a Research Assistant for the Bureau of Economic Geology. She conducted library research and compiled data for the Texas Mineral Resource Map and Texas Mineral Atlas.

The major emphasis in Ms. Richmann's undergraduate and graduate level training was in igneous and metamorphic petrology and geochemistry. Her Master's thesis included thin section analysis and Rb-Sr isotopic age determinations of two Precambrian gneisses from the Llano, Texas region.

HONORARY AND PROFESSIONAL SOCIETIES:

Phi Kappa Phi, Sigma Gamma Epsilon, American Association of Petroleum Geologists, Geological Society of America.

RADIAN
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Debra L. Richmann

PUBLICATIONS/REPORTS:

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Kaiser, W.R., K. Magara, K.L. Milliken, and D.L. Richmann, "Petrography, Water-Rock Interaction, and Caprock Distribution as Potential Indicators of Secondary Porosity in the Frio and Vicksburg Formations of Texas" (abstract), GSA South Central Section Annual Meeting, San Antonio, TX, 1981.

Kaiser, W.R., K. Magara, K.L. Milliken, K.L., and D.L. Richmann, "Sandstone Consolidation III Year End Report (1980)," Geothermal Energy, U.S. Department of Energy, DOE/ET/27111-2, 14 p. + figs., 1981.

Loucks, R.G., D.L. Richmann, K.L. and Milliken, "Factors Controlling Reservoir Quality in Tertiary Sandstones and Their Significance to Geopressured Geothermal Production: Report of Investigations No. 111," Bureau of Economic Geology, University of Texas at Austin, 41 p., 1981.

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Debra L. Richmann

Garrison, J.R., L.E. Long, D.L. and Richmann, "Rb-Sr and K-Ar Geochronologic and Isotopic Studies, Llano Uplift, Central Texas," Contributions to Mineralogy and Petrology, v. 69, p. 361-374, 1979.

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Richmann, D.L. and J.M. King, "A Review of EPA's Proposed Secondary NAAQS for Ozone, Based on Effects on Vegetation," API Staff Report submitted to PCO/NO_x Steering Committee, 1978.

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Richmann, D.L., "Rb-Sr Ages of the Red Mountain and Big Branch Gneisses, Llano Uplift, Central Texas," M.A. Thesis, The University of Texas at Austin, 51 p., 1977.

FRANCIS J. SMITH

EDUCATION:

M.S., Sanitary Engineering, Massachusetts Institute of Technology, 1954.

B.S., Civil Engineering, University of Michigan, 1950.

EXPERIENCE:

Program Manager, Research and Engineering Operations, Radian Corporation, McLean, Virginia, 1981-Present.

Senior Associate, Occupational Health and Safety, Environmental Engineering, A.T. Kearney Managerment Consultants, Alexandria, Virginia, 1980-1981.

Acting Chief Environmental Planning, Logistics and Engineering, Headquarters USAF, Washington, D.C., 1979-1980.

Chief Environmental Policy, Logistics and Engineering, Headquarters USAF, Washington, D.C., 1976-1979.

Director Environmental Protection, Air Force Systems Command (AFSC), Andrews AFB, Maryland, 1972-1976.

Chief Bioenvironmental Engineering, Headquarters Pacific Air Force, Hickam AFB, Hawaii, 1968-1972.

Similar assignments at Headquarters Alaskan Air Command, Headquarters Tactical Air Command and at Subcommands of Strategic Air Command, 1951-1968.

Junior Industrial Waste Engineer, Lederle Division, American Cyanamide, Pearl River, New York, 1950-1951.

RELEVANT EXPERIENCE:

Mr. Smith is the program manager for the Radian Basic Ordering Agreement (BOA) with the Air Force Engineering and Services Center (AFESC). It includes provision of a broad range of environmental engineering and hazardous waste management services. He is also responsible for coordinating Radian marketing to the Department of Defense. Among the areas of concern are: all aspects of the environment, occupational safety and health, hazardous wastes, analytical services and robotics.

He was the certified industrial hygienist and consultant for A.T. Kearney Management Consultants. In addition to the routine occupational safety and health activities he specialized in the interpretation of the EPA RCRA regulations. He coordinated the preparation of the proposal to EPA which brought Kearney the award of the first contract to provide RCRA technical assistance to EPA.

While at Kearney, he also participated in a health and safety evaluation of cement plants that sought to burn chemical wastes. He co-authored a feasibility study on "Assessment of Waste Fuel Use in Cement Kilns." In the same area of concern, he prepared a Draft Environmental Impact Statement (DEIS) on the burning of chemical wastes at a cement kiln. For the National Highway Safety Transportation Agency, he prepared the technical portions of a report on the testing of truck tire noise.

For three of the last four years in his assignment with Headquarters USAF, he was responsible for air, land and water pollution abatement programs. This included programming an average of $19 million per year. Also included were: the implementation of RCRA hazardous waste management; the first USAF installation restoration program (equivalent of CERCLA-superfund); management of 17 million acres of natural resources; and the NEPA environmental impact analysis program.

In addition to these activities, he assumed responsibility for one year for the rest of Environmental Planning. This included: comprehensive base planning; the Air Installation Compatibility Use Zone (AICUZ) plans for acquiring land near bases with high noise or accident potential; and development of environmental methodologies.

At the Air Force Systems Command (AFSC), Mr. Smith organized an office to address effects of the New Federal environmental laws on the Research, Development and Acquisition programs. This office, which reported to the AFSC Chief of Staff was the highest level environmental activity ever established at a USAF major command. He directed almost all of the environmental impact statements (EIS) issued by the Air Force in this period. As part of implementation of the National Environmental Policy Act, Mr. Smith implemented a computerized system for all Research and Development projects, programs, and tasks. The program is still in effect. On two occasions, he was an expert witness for the Federal government. One was a suit over the health hazards associated with the siting of new type radar stations in California and Massachusetts. The other pertained to the environmental impact statement (EIS) for new facilities at Colorado Springs, Colorado.

Additionally, he was responsible for advising on the industrial hygiene and environmental needs of government owned contractor operated (GOCO) industrial plants. In this assignment and all that follow, a part of each was spent in conducting health and environment compliance inspections and audits at military installations.

During his assignment to the Pacific Air Force, Mr. Smith provided environmental and industrial hygiene guidance to USAF activities in Korea, Japan, Taiwan, Vietnam, Thailand, Philippine Islands, Guam, Trust Territories and Hawaii. This included the traditional areas of sanitary engineering (water supply, treatment and distribution; waste collection, treatment and disposal; and pest control). It also included more modern problems, such as LASER equipment calibration, maintenance and use; handling of large volumes of herbicides; noise control; industrial hygiene; and heat and cold extremes; decontamination and quarantine of equipment to prevent introduction of foreign

fauna or flora into the U.S.A. from Asia. For four years, Mr. Smith was a member of the United States delegation to the South East Asia Treaty Organization (SEATO) Military Committee. He represented the U.S.A. with regard to public health engineering policies. Mr. Smith also evaluated USAF civic action programs to provide basic water and waste disposal to rural Thai villages.

The earlier USAF assignments in various commands provided environmental engineering and industrial hygiene support for the combat Air Force. Many of the previously mentioned activities were carried out as well as support for the current priority preventive medical activities. Some examples of the latter would be: defense against accidental release or deliver and use of chemical agents; improved water treatment plant operations; improved wastewater facilities and operations; conversion of dumps to sanitary fills; substitution of less toxic materials; engineering control of working exposures.

Mr. Smith worked for American Cyanamide on improving the industrial wastewater treatment of the flows from penicillin production.

CERTIFICATIONS/REGISTRATIONS AND PROFESSIONAL SOCIETIES:

Certified Industrial Hygienist by the American Board of Industrial Hygiene, 1971, No. 690.

Certified Safety Professional by the Board of Certified Safety Professionals of the Americas, 1972, No. 2103.

Registered Professional Engineer, State of Massachusetts, 1963, No. 19021.

Diplomate, American Academy of Environmental Engineers.

American Industrial Hygiene Association (National and Baltimore-Washington).

American Conference of Government Industrial Hygienists.

National (and Maryland) Society of Professional Engineers.

Federal Water Quality Association.

American Defense Preparedness Association.

Air Force Association.

APPENDIX B

List of Interviewees
(Base Personnel and Outside Agency Contacts)

BASE INTERVIEWEES

Shop Affilitation	Dates of Tenure
NDI, Welding & Plating	1972 - present
Wheel & Tire Repair, Chemical Cleaning	1955 - 1984
Wheel & Tire repair	1974 - present
Flight Line	1950 - present
Heavy Equipment Operator	1949 - 1984
Base Engineer	1941 - 1947
Grounds Foreman	1962 - present
Heavy Equipment Operator	1958 - present
Electrical Shop	1950 - 1980
Heavy Equipment Operator	1953 - present
Field Maintenance	1949 - 1983
Engineer	1953 - 1977
Entomology	1967 - present
Planner	1975 - present
Instrument Technician	1957 - present
Warehouse	1960 - present
Real Property	1949 - present
DPDO	1966 - present
Personnel	1977 - present
Heavy Equipment Operator	1946 - 1977
Landfill Operator	1950 - 1973
Fire Department	1980 - present
Fire Department	1965 - present
Fire Department	1970 - present

OUTSIDE AGENCY CONTACTS

Name	Affiliation/Location
Linda Wyatt	TDH, Lubbock
Raymond Mittel	TDWR, Lubbock
Dr. Francis L. Rose	Texas Tech, Lubbock
Wayne Wyatt	High Plains Water Conservation District, Lubbock
Dr. Reeves	Texas Tech, Lubbock
Robert Ray	TDH, Austin
Jim Hiland	EPA, Dallas
Donald D. Smith	High Plains Water Conservation District, Lubbock

APPENDIX C

Hazard Assessment Rating Methodology
(HARM) Used on Reese AFB

USAF INSTALLATION RESTORATION PROGRAM

HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

The Department of Defense (DOD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DOD facilities. One of the actions required under this program is to:

> "develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts." (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Records Search phase of its Installation Restoration Program (IRP).

The first site rating model was developed in June 1981 at a meeting with representatives from USAF Occupational Environmental Health Laboratory (OEHL), Air Force Engineering Services Center (AFESC), Engineering-Science (ES) and CH_2M Hill. The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for 6 months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of USAF OEHL, AFESC, various major commands, Engineering Science, and CH_2M Hill met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

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PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air Force in setting priorities for follow-on site investigations and confirmation work under Phase II of IRP.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DOD program needs.

The model uses data readily obtained during the Record Search portion (Phase I) of the IRP. Scoring judgments and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards at the site. This approach meshes well with the policy for evaluating and setting restrictions on excess DOD properties.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: the possible receptors of the contamination, the waste and its characteristics, potential pathways for waste contaminant migration, and any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant and adding the weighted scores to obtain a total category score.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned and for direct evidence 100 points are assigned. If no evidence is found, the highest score among three possible routes is used. These routes are surface water migration, flooding, and ground-water migration. Evaluation of each route involves factors associated with the particular migration route. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The scores for each of the three categories are then added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Sites at which there is no containment are not reduced in score. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste managment practices category factor to the sum of the scores for the other three categories.

HAZARD ASSESSMENT RATING METHODOLOGY FLOW CHART

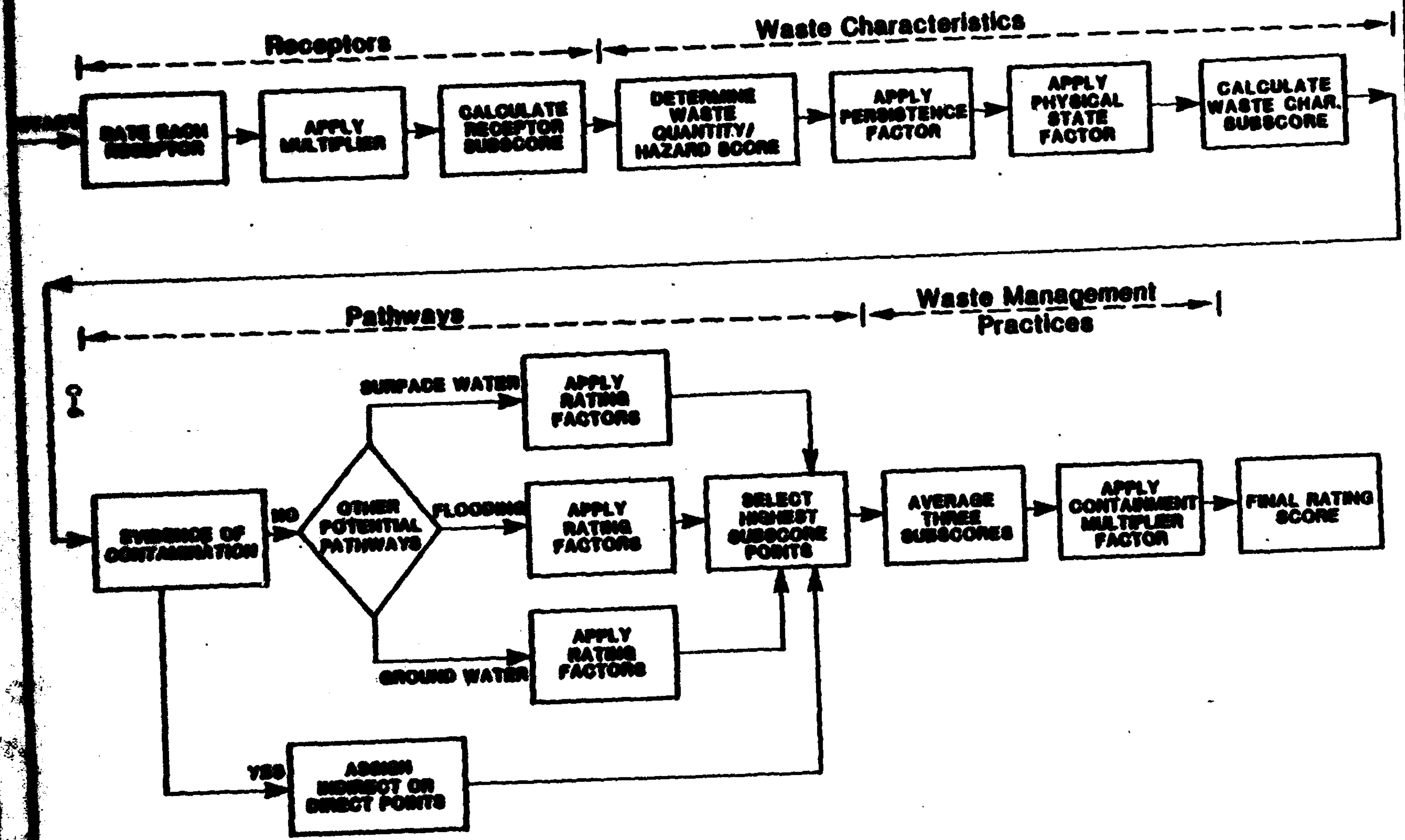

FIGURE 1

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE ______________________________

LOCATION ______________________________

DATE OF OPERATION OR OCCURRENCE ______________________________

OWNER/OPERATOR ______________________________

COMMENTS/DESCRIPTION ______________________________

SITE RATED BY ______________________________

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to reservation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site		6		
I. Population served by ground-water supply within 3 miles of site		6		

Subtotals ______ ______

Receptors subscore (100 X factor score subtotal/maximum score subtotal) ______

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ______
2. Confidence level (C = confirmed, S = suspected) ______
3. Hazard rating (H = high, M = medium, L = low) ______

Factor Subscore A (from 20 to 100 based on factor score matrix) ______

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		

Subtotals ______ ______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding		1		

Subscore (100 x factor score/3) ______

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		

Subtotals ______ ______

Subscore (100 x factor score subtotal/maximum score subtotal) ______

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ X ______ = [ ]

TABLE 1

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels: 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1 - 25	26 - 100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1 mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1 mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination.	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands.	10
F. Water quality/use designation of nearest surface water body	Agricultural or industrial use.	Recreation, propagation and management of fish and wildlife.	Shellfish propagation and harvesting.	Potable water supplies	6
G. Ground-Water use of uppermost aquifer	Not used, other sources readily available.	Commercial, industrial, or irrigation, very limited other water sources.	Drinking water, municipal water available.	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available.	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1 - 50	51 - 1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1 - 50	51 - 1,000	Greater than 1, 000	6

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (<5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (>20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- Verbal reports from interviewer (at least 2) or written information from the records.
- Knowledge of types and quantities of wastes generated by shops and other areas on base.
- Based on the above, a determination of the types and quantities of waste disposed of at the site.

S = Suspected confidence level

- No verbal reports or conflicting verbal reports and no written information from the records.
- Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site.

A-3 Hazard Rating

Hazard Category	Rating Scale Levels: 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS (Continued)

Waste Characterization Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	M
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:
Confidence Level
- o Confirmed confidence levels (C) can be added
- o Suspected confidence levels (S) can be added
- o Confirmed confidence levels cannot be added with suspected confidence levels

Waste Hazard Rating
- o Wastes with the same hazard rating can be added
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 POTENTIAL FOR SURFACE WATER CONTAMINATION

Rating Factor	Rating Scale Levels: 0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 in.	-10 to + 5 in.	+5 to +20 in.	Greater than +20 in.	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1 year 24-hr rainfall	<1.0 inch	1.0-2.0 inches	2.1-3.0 inches	>3.0 inches	8

B-2 POTENTIAL FOR FLOODING

Rating Factor	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 25-year floodplain	In 10-year floodplain	Floods annually	1

B-3 POTENTIAL FOR GROUND-WATER CONTAMINATION

Rating Factor	0	1	2	3	Multiplier
Depth to ground water	Greater than 500 ft	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 in.	-10 to +5 in.	+5 to +20 in.	Greater than +20 in.	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casings, subsidence fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. WASTE MANAGEMENT PRACTICES FACTOR

The following multipliers are then applied to the total risk points (from A):

<u>Waste Management Practice</u>	<u>Multiplier</u>
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

<u>Landfills:</u>

- Clay cap or other impermeable cover
- Leachate collection system
- Liners in good condition
- Adequate monitoring wells

<u>Spills:</u>

- Quick spill cleanup action taken
- Contaminated soil removed
- Soil and/or water samples confirm total cleanup of the spill

<u>Surface Impoundments:</u>

- Liners in good condition
- Sound dikes and adequate freeboard
- Adequate monitoring wells

<u>Fire Protection Training Areas:</u>

- Concrete surface and berms
- Oil/water separator for pretreatment of runoff
- Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1 or III-B-3, then leave blank for calculation of factor score and maximum possible score.

APPENDIX D

Supplemental Environmental Data

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NUMBER
	93321-23 00008	35800234 00020

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION	Well #9
8. SITE LOCATION NO	Ø165PGØ17
9. FLOWRATE AT SITE 00058 GAL/MIN	
10. WEATHER 00041	0
11. COLLECTION DATE/PERIOD	2 Dec 80
12. NAME OF COLLECTOR	Hensley
13. SAMPLING TECHNIQUE	Grab
14. PHONE NUMBER	838-3327
15. REASON FOR SAMPLE SUBMISSION	3 yr Chem ANAL IAW 161-44
5. DATE RECEIVED BY LAB	9 Dec. 80
6. DATE ANALYSIS COMPLETED	3 Jan. 81

ON-SITE ANALYTICAL RESULTS

16. WATER TEMP 00010 °C	17. PH 00400 UNITS	18. DISS O_2 00300 MG/L
21.6	8.1	2

19. RESULTS OF OTHER ON-SITE ANALYSES

ANALYSES REQUESTED AND RESULTS

A. PRIMARY DRINKING WATER STANDARDS (40CFR 141)

321 PRESERVATION GROUP F 029

PARAMETER	TOTAL	µ G/L	MAX LEV ALLWD
ARSENIC	01002	11.	50 µ G/L
BARIUM	01007	<1000.	1000 µ G/L
CADMIUM	01027	<10.	10. µ G/L
CHROMIUM	01034	140.	50 µ G/L
LEAD	01051	<20.	50 µ G/L
MERCURY	71900	<2.	2 µ G/L
SELENIUM	01147	<10.	10 µ G/L
SILVER	01077	<10.	50 µ G/L

322 PRESERVATION GROUP C 319

PARAMETER	TOTAL	MG/L	MAX LEV ALLWD
NITRATE AS N (Cadmium Reduction Method)	00620	1.7	10 MG/L

323 PRESERVATION GROUP G 508

PARAMETER	TOTAL	MG/L	MAX LEV ALLWD
FLUORIDE	00951	6.0	See table in AFR 161-44
TURBIDITY	00076	2 Units	1 Unit

B. OTHER ANALYSES

PRESERVATION GROUP F

PARAMETER	TOTAL	µG/L
COPPER	01042	.
IRON	01045	.
MANGANESE	01055	
ZINC	01092	.
CALCIUM As Ca	00916	. mg/l
MAGNESIUM as Mg	00927	. mg/l
POTASSIUM	00937	. mg/l
SODIUM	00929	. mg/l

PRESERVATION GROUP G

PARAMETER	TOTAL	MG/L
Acidity, Mineral As $CaCO_3$	00436	.
Acidity, Total, As $CaCO_3$	00435	.
Alkalin, Phenolth As $CaCO_3$	00415	
Alkalinity, Total, As $CaCO_3$	00410	
Chloride	00940	
Hardness As $CaCO_3$	00900	.
Residue, Filtrable (TDS)	00515	.
Residue, Non-Filtrable (SS)	00530	.
Residue	00500	
Specific Conductance	00095	µmhos

PARAMETER	TOTAL	MG/L
Sulfate As SO_4	00945	.
Surfactants MBAS As LAS	38260	.

PRESERVATION GROUP J

PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS

USAF HOSPITAL REESE/SGPM
REESE AFB, TX. 79489

CHEMIST

[illegible signature]

REVIEWED BY

JAMES A. COLLINS
MAJOR USAF, BSC
CHIEF, QUALITY ASSURANCE

APPROVED BY

[illegible signature]

OEHL FORM NOV 78 2 POTABLE WATER ANALYSIS

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2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NUMBER
	93318-20 00008	35800233 00020

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION	Well #1
5. DATE RECEIVED BY LAB	9 Dec 80
6. DATE ANALYSIS COMPLETED	30 Jan 81
8. SITE LOCATION NO	0165PG009
9. FLOWRATE AT SITE 00056 GAL/MIN	
10. WEATHER 00041	0
11. COLLECTION DATE/PERIOD	2 Dec 80
12. NAME OF COLLECTOR	Hensley
13. SAMPLING TECHNIQUE	Grab
14. PHONE NUMBER	838-3327
15. REASON FOR SAMPLE SUBMISSION	3 Yr Chem ANAL IAW 161-44

ON-SITE ANALYTICAL RESULTS

16. WATER TEMP 00010 °C	17. PH 00400 UNITS	18. DISS O_2 00300 MG/L
23.3	7.6	3

19. RESULTS OF OTHER ON-SITE ANALYSES

Dec 9 12 53 PM

ANALYSES REQUESTED AND RESULTS

A. PRIMARY DRINKING WATER STANDARDS (40CFR 141)

318 PRESERVATION GROUP F 029

PARAMETER	TOTAL	µG/L	MAX LEV ALLWD
ARSENIC	01002	<10	50 µG/L
BARIUM	01007	<1000	1000 µG/L
CADMIUM	01027	<10	10 µG/L
CHROMIUM	01034	<50	50 µG/L
LEAD	01051	<20	50 µG/L
MERCURY	71900	<2	2 µG/L
SELENIUM	01147	<10	10 µG/L
SILVER	01077	<10	50 µG/L

319 PRESERVATION GROUP G 310

PARAMETER	TOTAL	MG/L	MAX LEV ALLWD
NITRATE AS N (Cadmium Reduction Method)	00620	1.5	10 MG/L

328 PRESERVATION GROUP 008

PARAMETER	TOTAL	MG/L	MAX LEV ALLWD
FLUORIDE	00951	10.0	See table in AFR 161-44
TURBIDITY	00076	2 Units	1 Unit

B. OTHER ANALYSES

PRESERVATION GROUP F

PARAMETER	TOTAL	µG/L
COPPER	01042	
IRON	01045	
MANGANESE	01055	
ZINC	01092	
CALCIUM As Ca	00916	mg/l
MAGNESIUM as Mg	00927	mg/l
POTASSIUM	00937	mg/l
SODIUM	00929	mg/l

PRESERVATION GROUP G

PARAMETER	TOTAL	MG/L
Acidity, Mineral As $CaCO_3$	00436	
Acidity, Total, As $CaCO_3$	00435	
Alkalin, Phenolth As $CaCO_3$	00415	
Alkalinity, Total, As $CaCO_3$	00410	
Chloride	00940	
Hardness As $CaCO_3$	00900	
Residue, Filtrable (TDS)	00515	
Residue, Non-Filtrable (SS)	00530	
Residue	00500	
Specific Conductance	00095	µmhos

PARAMETER	TOTAL	MG/L
Sulfate As SO_4	00945	
Surfactants MBAS As LAS	38260	

PRESERVATION GROUP J

PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS

USAF HOSPITAL REESE/SGPM
REESE AFB, TX. 79489

CHEMIST

REVIEWED BY
JAMES A. COLLINS
MAJOR USAF, BSC
CHIEF, QUALITY ASSURANCE

APPROVED BY

OEHL FORM 2 NOV 78

POTABLE WATER ANALYSIS

Recd 09 Feb 84 84.12

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NUMBER
CEHL 27 JAN 84	17 07 4106 00008	GP840011 00020

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION: Well #9		5. DATE RECEIVED BY LAB: 27 Jan. 84	6. DATE ANALYSIS COMPLETED: 2 Feb. 84
8. SITE LOCATION NO	9. FLOWRATE AT SITE 00058 GAL/MIN	10. WEATHER 00041	
11. COLLECTION DATE/PERIOD: 24 Jan 84	12. NAME OF COLLECTOR		
13. SAMPLING TECHNIQUE	14. PHONE NUMBER		
15. REASON FOR SAMPLE SUBMISSION			

ON-SITE ANALYTICAL RESULTS

16. WATER TEMP 000 10 °C	17. PH 00400 UNITS	18. DISS O_2 00300 MG/L

19. RESULTS OF OTHER ON-SITE ANALYSES

ANALYSES REQUESTED AND RESULTS

A. PRIMARY DRINKING WATER STANDARDS (40CFR 141)

106 05L

PRESERVATION GROUP F

PARAMETER	TOTAL	µG/L	MAX LEV ALLWD
ARSENIC	01002	.	50 µ G/L
BARIUM	01007	.	1000 µ G/L
CADMIUM	01027	.	10. µ G/L
CHROMIUM	01034	132.	50 µ G/L
LEAD	01051	.	50 µ G/L
MERCURY	71900	.	2 µ G/L
SELENIUM	01147	.	10 µ G/L
SILVER	01077	.	50 µ G/L

PRESERVATION GROUP C

PARAMETER	TOTAL	MG/L	MAX LEV ALLWD
NITRATE AS N (Cadmium Reduction Method)	00620	.	10 MG/L

PRESERVATION GROUP G

PARAMETER	TOTAL	MG/L	MAX LEV ALLWD
FLUORIDE	00951	.	See table in AFR 161-44
TURBIDITY	00076	Units	1 Unit

B. OTHER ANALYSES

PRESERVATION GROUP F

PARAMETER	TOTAL	µG/L
COPPER	01042	.
IRON	01045	.
MANGANESE	01055	.
ZINC	01092	.
CALCIUM As Ca	00916	. MG/L
MAGNESIUM as Mg	00927	. MG/L
POTASSIUM	00937	. MG/L
SODIUM	00929	. MG/L
Hexavalent Chrom		48

PRESERVATION GROUP G

PARAMETER	TOTAL	MG/L	PARAMETER	TOTAL	MG/L
Acidity, Mineral As $CaCO_3$	00436	.	Sulfate As SO_4	00945	.
Acidity, Total, As $CaCO_3$	00435	.	Surfactants MBAS As LAS	38260	.
Alkalin, Phenolth As $CaCO_3$	00415	.			
Alkalinity, Total, As $CaCO_3$	00410	.			
Chloride	00940	.			
Hardness As $CaCO_3$	00900	.			
Residue, Filtrable (TDS)	00515	.	PRESERVATION GROUP J		
Residue, Non-Filtrable (SS)	00530	.	PARAMETER		
Residue	00500	.			
Specific Conductance	00095	µmhos			

ORGANIZATION REQUESTING ANALYSIS	
USAF Hosp/SGPB Reese AFB TX 79489	CHEMIST: WB EN. 011
	REVIEWED BY
	APPROVED BY: [signature]

Industrial Waste Lake

Sample: 10 feet from inlet (soil sample) surface)*
Date of Sampling: 24 Mar 83

Analysis Results:

Parameter	ug/g
Barium	27.6
Cadmium	20.4
Chromium	109.1
Hexavalent Chromium	<0.04
Lead	192.6
Mercury	36

Sample: 5 feet from pipe and 1 foot deep (soil sample)*
Date of Sample: 24 Mar 83

Analysis Results:

Parameter	ug/g
Barium	75.4
Cadmium	45.7
Chromium	236.5
Hexavalent Chromium	<0.04
Lead	350
Mercury	102

Sample: 30 feet north of pipe by 30 feet straight out (soil sample)*
Date of Sample: 24 Mar 83

Analysis Results:

Parameter	ug/g
Barium	269.0
Cadmium	148.0
Chromium	708.0
Hexavalent Chromium	<0.04
Lead	1048
Mercury	520

* Samples were taken after the lake water level had been lowered for dredging purposes.

Feb 77 - Sept 81 (Semi-Annual Samples)

Chemicals	(Sewage Lake) IRR. Intake	(C.E. Oil Sup. Outfall) Ind. Waste Inf.	(Near I.W. Lake Pump) Ind. Waste Effluent
Cadmium -	< 10 μgms/l.	15-300 μg/l	< 10 - 17
Chromium (Total)	< 50	< 50 - 3400*	< 50 - 215
Lead	< 52-63	< 50 - 1330*	< 50 - 125
Mercury	< 5	< 5 - 6	< 5
Phenols	< 10	3 - 1500*	< 10 - 2900*
Toulene	Not	Tested	1 On
MEK	"	"	"

* 1978 Sample

These are ranges of twice per time samples taken during the Feb 77 - Sept 81 time frame.

File 1386 [illegible] 08 12

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	REQUESTOR SAMPLE NO
OEHL	46188-194 00008	GN 830083 00028

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION	5. DATE RECEIVED BY LAB	6. DATE ANALYSIS COMPLETED
Industrial Waste Effluent	9 Sept. 83	19 Sept. 83

ON-SITE ANALYTICAL RESULTS

8. SITE LOCATION NO	9. FLOWRATE AT SITE 00058 GAL/MIN	10. WEATHER 00041	16. WATER TEMP 00010 °C	17. PH 00400 UNITS	18. DISS O2 00300 MG/L
	7 Sep 83 [illegible] 83	5c			

11. COLLECTION DATE/PERIOD	12. COLLECTORS NAME	19. RESULTS OF OTHER ON-SITE ANALYSES
13. SAMPLING TECHNIQUE	14. PHONE NUMBER	
15. REASON FOR SAMPLE SUBMISSION		
NPDES 5		

ANALYSES REQUESTED AND RESULTS

188 PRESERVATION GROUP A 256

PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	65.
Total Organic CARBON as C	00680	27.

189 PRESERVATION GROUP B 257

PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	11

190 PRESERVATION GROUP C 250

PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	0.3
NITRATE as N Cd Reduct. Method	00620	<.1
NITRITE as N	00615	.
TOTAL KJELDAHL NITROGEN as N	00625	.
PHOSPHORUS Ortho PO4 as P	70507	0.65
PHOSPHORUS as P	00665	.

191 PRESERVATION GROUP D 258

PARAMETER	TOTAL	MG/L
CYANIDE	00720	<.01
CYANIDE Free, Amenable to Cl_2	00722	.

192 PRESERVATION GROUP E [illegible]

PARAMETER	TOTAL	MG/L
PHENOLS	[illegible]	<10.

193 PRESERVATION GROUP F 255

PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	01002	.
BARIUM	01005	01007	.
CADMIUM	01025	01027	<10.
CHROMIUM	01030	01034	<50.
CHROMIUM Hexavalent		01032	<50.
COPPER	01040	01042	.
IRON	01046	01045	202.
LEAD	01049	01051	
MANGANESE	01056	01055	269.
MERCURY	71890	71900	.
NICKEL	01065	01067	.
SELENIUM	01145	01147	.
SILVER	01075	01077	.
ZINC	01090	01092	.
CALCIUM as Ca	00915	00916	. MG/L
MAGNESIUM as Mg	00925	00927	. MG/L
POTASSIUM	00935	00937	. MG/L
SODIUM	00930	00929	. MG/L

194 PRESERVATION GROUP G 254

PARAMETER	TOTAL	MG/L
BORON	01022	. µG/L
BORON, Dissolved	01020	. µG/L
CHLORIDE	00940	7.1
COLOR	00080	* 45 Units
FLUORIDE	00951	.
Residue Filterable (TDS)	00515	.
Residue Non Filt (SS)	00530	.
Residue	00500	.
Residue Volatile	00505	.
Specific Conductance	00095	µmhos
SULFATE as SO_4	00945	7.
SURFACTANTS MBAS as LAS	38260	0.9
TURBIDITY	00076	10 Units

*Sample Filtered for Color

PRESERVATION GROUP I

PARAMETER	

1. ORGANIZATION REQUESTING ANALYSIS	CHECKED
Pease AFB	KAH [illegible]

[illegible]

File 13B-6 ~~File~~ 1881 09/12

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	REQUESTOR SAMPLE NO
OEHL	46187 00008	GN 830083 00029

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION: Industrial Waste Effluent

5. DATE RECEIVED BY LAB: 7 Sept, 83

6. DATE ANALYSIS COMPLETED: 19 Sept, 83

ON-SITE ANALYTICAL RESULTS

8. SITE LOCATION NO	9. FLOWRATE AT SITE 00058 GAL/MIN	10. WEATHER 00041	16. WATER TEMP 00010 °C	17. PH 00400 UNITS	18. DISS O2 00300 MG/L

11. COLLECTION DATE/PERIOD

12. COLLECTOR'S NAME

19. RESULTS OF OTHER ON-SITE ANALYSES

13. SAMPLING TECHNIQUE

14. PHONE NUMBER

15. REASON FOR SAMPLE SUBMISSION

NPDES #

ANALYSES REQUESTED AND RESULTS

187 PRESERVATION GROUP A 257

PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	50
Total Organic CARBON as C	00680	23

PRESERVATION GROUP B

PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	

PRESERVATION GROUP C

PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	
NITRATE as N Cd Reduct. Method	00620	
NITRITE as N	00615	
TOTAL KJELDAHL NITROGEN as N	00625	
PHOSPHORUS Ortho PO4 as P	70507	
PHOSPHORUS as P	00665	

PRESERVATION GROUP D

PARAMETER	TOTAL	MG/L
CYANIDE	00720	
CYANIDE Free, Amenable to Cl_2	00722	

PRESERVATION GROUP E

PARAMETER	TOTAL	µG/L
PHENOLS	32730	

PRESERVATION GROUP F

PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	01002	
BARIUM	01005	01007	
CADMIUM	01025	01027	
CHROMIUM	01030	01034	
CHROMIUM Hexavalent		01032	
COPPER	01040	01042	
IRON	01046	01045	
LEAD	01049	01051	
MANGANESE	01056	01055	
MERCURY	71890	71900	
NICKEL	01065	01067	
SELENIUM	01145	01147	
SILVER	01075	01077	
ZINC	01090	01092	
CALCIUM as Ca	00915	00916	MG/L
MAGNESIUM as Mg	00925	00927	MG/L
POTASSIUM	00935	00937	MG/L
SODIUM	00930	00929	MG/L

PRESERVATION GROUP G

PARAMETER	TOTAL	MG/L
BORON	01022	µG/L
BORON, Dissolved	01020	µG/L
CHLORIDE	00940	
COLOR	00080	Units
FLUORIDE	00951	
Residue Filterable (TDS)	00515	
Residue Non Filt (SS)	00530	
Residue	00500	
Residue Volatile	00505	
Specific Conductance	00095	µmhos
SULFATE as SO_4	00945	
SURFACTANTS MBAS as LAS	38260	
TURBIDITY	00076	Units

PRESERVATION GROUP J

PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS

Reese AFB

CHEMIST

REVIEWED BY

APPROVED BY

D-9

OEHL FORM 1 NOV 78

NON-POTABLE WATER ANALYSIS

09.12

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NO
	22449-451	2 00029

SAMPLE COLLECTION INFORMATION			5. DATE RECEIVED BY LAB	6. DATE ANALYSIS COMPLETED
7. SITE DESCRIPTION			26 May 82	4 June 82
			ON-SITE ANALYTICAL RESULTS	
8. SITE LOCATION NO	9. FLOWRATE AT SITE 00058 GAL/MIN	10. WEATHER 00041	16. WATER TEMP 00010 °C / 17. PH 00400 UNITS	18. DISS O2 00300 MG/L
11. COLLECTION DATE/PERIOD		12. COLLECTORS NAME	19. RESULTS OF OTHER ON-SITE ANALYSES	
13. SAMPLING TECHNIQUE		14. PHONE NUMBER		
15. REASON FOR SAMPLE SUBMISSION NPDES a				

ANALYSES REQUESTED AND RESULTS

PRESERVATION GROUP A		
PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	
Total Organic CARBON as C	00680	

449 PRESERVATION GROUP B 148

PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	1.4

PRESERVATION GROUP C		
PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	
NITRATE as N Cd Reduct. Method	00630	
NITRITE as N	00615	
TOTAL KJELDAHL NITROGEN as N	00625	
PHOSPHORUS Ortho PO4 as P	70507	
PHOSPHORUS as P	00665	

PRESERVATION GROUP D		
PARAMETER	TOTAL	MG/L
CYANIDE	00720	
CYANIDE Free, Amenable to Cl_2	00722	

451 PRESERVATION GROUP E 153

PARAMETER	TOTAL	MG/L
PHENOLS	32730	<10

451 PRESERVATION GROUP F 154

PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	01002	<10
BARIUM	01005	01007	<1000
CADMIUM	01025	01027	<10
CHROMIUM	01030	01034	<50
CHROMIUM Hexavalent		01032	<50
COPPER	01040	01042	34
IRON	01046	01045	691
LEAD	01049	01051	<50
MANGANESE	01056	01055	63
MERCURY	71890	71900	<5
NICKEL	01065	01067	51
SELENIUM	01145	01147	<10
SILVER	01075	01077	<10
ZINC	01090	01092	<50
CALCIUM as Ca	00915	00916	18.8 mg/l
MAGNESIUM as Mg	00925	00927	4.9 mg/l
POTASSIUM	00935	00937	19.5 mg/l
SODIUM	00930	00929	27.6 mg/l
		510	510
			<10
			67 mg/l

PRESERVATION GROUP G		
PARAMETER	TOTAL	MG/L
BORON	01022	µg/l
BORON, Dissolved	01020	µg/l
CHLORIDE	00940	
COLOR	00080	Units
FLUORIDE	00951	
Residue Filterable (TDS)	00515	
Residue Non Filt (SS)	00530	
Residue	00500	
Residue Volatile	00505	
Specific Conductance	00095	µmhos
SULFATE as SO_4	00945	
SURFACTANTS MBAS as LAS	38260	
TURBIDITY	00076	Units

PRESERVATION GROUP J		
PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS

Antimony = <10 uG/L
Thallium = <10 uG/L

OSAF HUS P/SGPM
TX 79489

E-10

CHEMIST

REVIEWED BY

APPROVED BY

09.12

2. LABORATORY PERFORMING ANAL	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NO
	6465-71 00008	[illegible] 00029

SAMPLE COLLECTION INFORMATION		5. DATE RECEIVED BY LAB	6. DATE ANALYSIS COMPLETED
7. SITE DESCRIPTION: Industrial Waste Eff. [illegible]		20 Feb 81	11 Apr 81

8. SITE LOCATION NO	9. FLOWRATE AT SITE 00058 GAL/MIN	10. WEATHER 00041	16. WATER TEMP 00010 °C	17. PH 00400 UNITS	18. DISS O2 00300 MG/L
15-81-0266			9.4	7.5	

ON-SITE ANALYTICAL RESULTS

11. COLLECTION DATE/PERIOD: 7 Feb 81 - 0930
12. COLLECTORS NAME: C. E. Hensley
13. SAMPLING TECHNIQUE: Grab sample at surface
14. PHONE NUMBER: 838-3327
15. REASON FOR SAMPLE SUBMISSION: NPDES = None Routine local policy monitoring
19. RESULTS OF OTHER ON-SITE ANALYSES

ANALYSES REQUESTED AND RESULTS

65 PRESERVATION GROUP A			70 PRESERVATION GROUP F				71 PRESERVATION GROUP G		
PARAMETER	TOTAL	MG/L	PARAMETER	DISS	TOTAL	µG/L	PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	142.	ARSENIC	01000	01002	.	BORON	01022	. µg/l
Total Organic CARBON as C	00680	37.	BARIUM	01005	01007	.	BORON, Dissolved	01020	. µg/l
			CADMIUM	01025	01027	20.	CHLORIDE	00940	44.
66 PRESERVATION GROUP B			CHROMIUM	01030	01034	263.	COLOR	00080	10 Units
PARAMETER	TOTAL	MG/L	CHROMIUM Hexavalent		01032	<50.	FLUORIDE	00951	.
OIL & GREASE FREON-IR Method	00560	1.4	COPPER	01040	01042	.	Residue Filterable (TDS)	00515	.
67 PRESERVATION GROUP C			IRON	01046	01045	737.	Residue Non Filt (SS)	00530	.
AMMONIA as N	00610	2.5	LEAD	01049	01051	.	Residue	00500	.
NITRATE as N Cd Reduct. Method	00620	0.4	MANGANESE	01056	01055	423.	Residue Volatile	00505	.
NITRITE as N	00615	.	MERCURY	71890	71900	.	Specific Conductance	00095	µmhos
TOTAL KJELDAHL NITROGEN as N	00625	.	NICKEL	01065	01067	.	SULFATE as SO_4	00945	50.
PHOSPHORUS Ortho PO4 as P	70507	4.7	SELENIUM	01145	01147	.	SURFACTANTS MBAS as LAS	38260	1.6
PHOSPHORUS as P	00665	.	SILVER	01075	01077	.	TURBIDITY	00076	35 Units
			ZINC	01090	01092	.			
68 PRESERVATION GROUP D			CALCIUM as Ca	00915	00916	. mg/l			
PARAMETER	TOTAL	MG/L	MAGNESIUM as Mg	00925	00927	. mg/l			
CYANIDE	00720	<.01	POTASSIUM	00935	00937	. mg/l			
CYANIDE Free, Amenable to Cl_2	00722	.	SODIUM	00930	00929	. mg/l			
69 PRESERVATION GROUP E							PRESERVATION GROUP J		
PARAMETER	TOTAL	µG/L					PARAMETER		
PHENOLS	32730	10.							

1. ORGANIZATION REQUESTING ANALYSIS

CHEMIST: [illegible signature]

REVIEWED BY

APPROVED BY: [illegible signature]

OEHL FORM 1 NOV 78

NON-POTABLE WATER ANALYSIS

09.12

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NO
USAF OEHL/SA BROOKS AFB TX 78235	77685-91 00005	14800219 00029

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION: 16504950000-00009/00 Industrial Waste Eff #5

5. DATE RECEIVED BY LAB: 3 Sept. 80
6. DATE ANALYSIS COMPLETED: 6 Oct. 80

8. SITE LOCATION NO:
9. FLOWRATE AT SITE 00058 GAL/MIN:
10. WEATHER 00041: 0

ON-SITE ANALYTICAL RESULTS

16. WATER TEMP 00010 °C	17. PH 00400 UNITS	18. DISS O2 00300 MG/L
75	1.2	0

11. COLLECTION DATE/PERIOD: 27 Aug 80 0800-1600
12. COLLECTORS NAME: A1C West & Thomas
13. SAMPLING TECHNIQUE: Grab sample at surface
14. PHONE NUMBER: A/V 838-3327
15. REASON FOR SAMPLE SUBMISSION: NPDES, None, Routine local policy monitoring
19. RESULTS OF OTHER ON-SITE ANALYSES: SEP 3 11 37 AM '80

ANALYSES REQUESTED AND RESULTS

685 PRESERVATION GROUP A 255

PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	130.
Total Organic CARBON as C	00680	48.

686 PRESERVATION GROUP B 256

PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	4.4

687 PRESERVATION GROUP C 269

PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	1.8
NITRATE as N Cd Reduct. Method	00620	<.1
NITRITE as N	00615	.
TOTAL KJELDAHL NITROGEN as N	00625	.
PHOSPHORUS Ortho PO4 as P	70507	0.7
PHOSPHORUS as P	00665	.

688 PRESERVATION GROUP D 252

PARAMETER	TOTAL	MG/L
CYANIDE	00720	<.01
CYANIDE Free, Amenable to Cl_2	00722	.

689 PRESERVATION GROUP E 254

PARAMETER	TOTAL	µG/L
PHENOLS	32730	<10.

690 PRESERVATION GROUP F 260

PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	01002	.
BARIUM	01005	01007	.
CADMIUM	01025	01027	<10.
CHROMIUM	01030	01034	124.
CHROMIUM Hexavalent		01032	<50.
COPPER	01040	01042	.
IRON	01046	01045	1003.
LEAD	01049	01051	.
MANGANESE	01056	01055	615.
MERCURY	71890	71900	.
NICKEL	01065	01067	.
SELENIUM	01145	01147	.
SILVER	01075	01077	.
ZINC	01090	01092	.
CALCIUM as Ca	00915	00916	. mg/l
MAGNESIUM as Mg	00925	00927	. mg/l
POTASSIUM	00935	00937	. mg/l
SODIUM	00930	00929	. mg/l

691 PRESERVATION GROUP G 273

PARAMETER	TOTAL	MG/L
BORON	01022	. µg/l
BORON, Dissolved	01020	. µg/l
CHLORIDE	00940	36.
COLOR	00080	80 Units
FLUORIDE	00951	.
Residue Filterable (TDS)	00515	.
Residue Non Filt (SS)	00530	.
Residue	00500	.
Residue Volatile	00505	.
Specific Conductance	00095	µmhos
SULFATE as SO_4	00945	16.
SURFACTANTS MBAS as LAS	38260	1.0
TURBIDITY	00076	21 Units

PRESERVATION GROUP J

PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS

BIOENVIRONMENTAL ENGINEERING
USAF Hospital Reese/SGPM
Reese AFB, Texas 79489

CHEMIST: [signature]
REVIEWED BY: COLLINS, MAJOR, USAF, BSC, CHIEF, QUALITY ASSURANCE
APPROVED BY: [signature]

D-12

OEHL FORM NOV 76 1 — NON-POTABLE WATER ANALYSIS

09.12

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NO
CEHL 6 APR 83 15 05	16369 00005	GR 83C042 00020

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION	5. DATE RECEIVED BY LAB	6. DATE ANALYSIS COMPLETED
(site ?) pond inlet pipe, 10' out surface	6 April 83	20 April 83

ON-SITE ANALYTICAL RESULTS

8. SITE LOCATION NO	9. FLOWRATE AT SITE 00058 GAL/MIN	10. WEATHER 00041	16. WATER TEMP 00010 °C	17. PH 00400 UNITS	18. DISS O2 00300 MG/L

11. COLLECTION DATE/PERIOD	12. COLLECTOR'S NAME	19. RESULTS OF OTHER ON-SITE ANALYSES
		sludge ?
13. SAMPLING TECHNIQUE	14. PHONE NUMBER	
15. REASON FOR SAMPLE SUBMISSION		
NPDES # Sampled for heavy metals		

ANALYSES REQUESTED AND RESULTS

PRESERVATION GROUP A

PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	.
Total Organic CARBON as C	00680	.
		.

PRESERVATION GROUP B

PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	[redacted]	.

PRESERVATION GROUP C

PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	.
NITRATE as N Cd Reduct. Method	00620	.
NITRITE as N	00615	.
TOTAL KJELDAHL NITROGEN as N	00625	.
PHOSPHORUS Ortho PO4 as P	70507	.
PHOSPHORUS as P	00665	.

PRESERVATION GROUP D

PARAMETER	TOTAL	MG/L
CYANIDE	00720	.
CYANIDE Free, Amenable to Cl_2	00722	.

PRESERVATION GROUP E

PARAMETER	TOTAL	µG/L
PHENOLS	32730	.

PRESERVATION GROUP F (10)

PARAMETER	DISS	TOTAL	µG/g
ARSENIC	01000	01002	.
BARIUM	01005	01007	21.6 µg/g
CADMIUM	01025	01027	20.4 µg/g
CHROMIUM	01030	01034	109.1 µg/g
CHROMIUM Hexavalent		01032	<.04 mg/l
COPPER	01040	01042	.
IRON	01046	01045	.
LEAD	01049	01051	1926 µg/g
MANGANESE	01056	01055	.
MERCURY	71890	71900	36 µg/g
NICKEL	01065	01067	.
SELENIUM	01145	01147	.
SILVER	01075	01077	.
ZINC	01090	01092	.
CALCIUM as Ca	00915	00916	. MG/L
MAGNESIUM as Mg	00925	00927	. MG/L
POTASSIUM	00935	00937	. MG/L
SODIUM	00930	00929	. MG/L

PRESERVATION GROUP G

PARAMETER	TOTAL	MG/L
BORON	01022	. µG/L
BORON, Dissolved	01020	. µG/L
CHLORIDE	00940	.
COLOR	00080	Units
FLUORIDE	00951	.
Residue Filterable (TDS)	00515	.
Residue Non Filt (SS)	00530	.
Residue	00500	.
Residue Volatile	00505	.
Specific Conductance	00095	µmhos
SULFATE as SO_4	00945	.
SURFACTANTS MBAS as LAS	38260	.
TURBIDITY	00076	Units

PRESERVATION GROUP J

PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS	CHEMIST
USAF HOSP/SGPB Reese AFB TX 79489	LSJ ...
	REVIEWED BY
	APPROVED BY
	[signature]

D-13

09.12

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NO
OEHL 6 APR 83	5 05 16310 00005	GN 830043 00020

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION: pond inlet pipe, 5' out, 1' deep

5. DATE RECEIVED BY LAB: 6 April 83

6. DATE ANALYSIS COMPLETED: 20 April 83

8. SITE LOCATION NO

9. FLOWRATE AT SITE 00050 GAL/MIN

10. WEATHER 00041

ON-SITE ANALYTICAL RESULTS

16. WATER TEMP 00010 °C

17. PH 00400 UNITS

18. DISS O2 00300 MG/L

11. COLLECTION DATE/PERIOD

12. COLLECTORS NAME

19. RESULTS OF OTHER ON-SITE ANALYSES

13. SAMPLING TECHNIQUE

14. PHONE NUMBER

15. REASON FOR SAMPLE SUBMISSION

NPDES # Sludge Sampled for heavy metals

ANALYSES REQUESTED AND RESULTS

PRESERVATION GROUP A

PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	.
Total Organic CARBON as C	00680	.
		.

PRESERVATION GROUP B

PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	.

PRESERVATION GROUP C

PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	.
NITRATE as N Cd Reduct. Method	00620	.
NITRITE as N	00615	.
TOTAL KJELDAHL NITROGEN as N	00625	.
PHOSPHORUS Ortho PO4 as P	70507	.
PHOSPHORUS as P	00665	.

PRESERVATION GROUP D

PARAMETER	TOTAL	MG/L
CYANIDE	00720	.
CYANIDE Free, Amenable to Cl_2	00722	.

PRESERVATION GROUP E

PARAMETER	TOTAL	UG/L
PHENOLS	32730	.

PRESERVATION GROUP F (WG)

PARAMETER	DISS	TOTAL	µg/g
ARSENIC	01000	01002	.
BARIUM	01005	01007	75.4
CADMIUM	01025	01027	43.7
CHROMIUM	01030	01034	236.5
CHROMIUM Hexavalent		01032	<.04
COPPER	01040	01042	.
IRON	01046	01045	.
LEAD	01049	01051	3540
MANGANESE	01056	01055	.
MERCURY	71890	71900	102
NICKEL	01065	01067	.
SELENIUM	01145	01147	.
SILVER	01075	01077	.
ZINC	01090	01092	.
CALCIUM as Ca	00915	00916	. MG/L
MAGNESIUM as Mg	00925	00927	. MG/L
POTASSIUM	00935	00937	. MG/L
SODIUM	00930	00929	. MG/L

PRESERVATION GROUP G

PARAMETER	TOTAL	MG/L
BORON	01022	. UG/L
BORON, Dissolved	01020	. UG/L
CHLORIDE	00940	.
COLOR	00080	Units
FLUORIDE	00951	.
Residue Filterable (TDS)	00515	.
Residue Non Filt (SS)	00530	.
Residue	00500	.
Residue Volatile	00505	.
Specific Conductance	00095	µmhos
SULFATE as SO_4	00945	.
SURFACTANTS MBAS as LAS	38260	.
TURBIDITY	00076	Units

PRESERVATION GROUP J

PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS: Reese AFB

CHEMIST: L33 — RH GG 3391

REVIEWED BY

APPROVED BY: [signature]

OEHL FORM 1 NOV 79 NON-POTABLE WATER ANALYSIS

09.12

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NO
CEHL 6 APR 83 1 3 0 5 8	16312 00008	GN 830044 00029

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION	pond inlet pipe, 30' out + 30' N
5. DATE RECEIVED BY LAB	6 April 83
6. DATE ANALYSIS COMPLETED	20 April 83
8. SITE LOCATION NO	
9. FLOWRATE AT SITE 00080 GAL/MIN	
10. WEATHER 00041	
11. COLLECTION DATE/PERIOD	
12. COLLECTOR'S NAME	
13. SAMPLING TECHNIQUE	
14. PHONE NUMBER	
15. REASON FOR SAMPLE SUBMISSION — NPDES #.	Sludge sampled for heavy metals

ON-SITE ANALYTICAL RESULTS

16. WATER TEMP 00010 °C	17. PH 00400 UNITS	18. DISS O2 00300 MG/L

19. RESULTS OF OTHER ON-SITE ANALYSES

ANALYSES REQUESTED AND RESULTS

PRESERVATION GROUP A		
PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	.
Total Organic CARBON as C	00680	.
		.
PRESERVATION GROUP B		
PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	.
PRESERVATION GROUP C		
PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	.
NITRATE as N Cd Reduct. Method	00620	.
NITRITE as N	00615	.
TOTAL KJELDAHL NITROGEN as N	00625	.
PHOSPHORUS Ortho PO4 as P	70507	.
PHOSPHORUS as P	00665	.
PRESERVATION GROUP D		
PARAMETER	TOTAL	MG/L
CYANIDE	00720	.
CYANIDE Free, Amenable to Cl_2	00722	.
PRESERVATION GROUP E		
PARAMETER	TOTAL	µG/L
PHENOLS	32730	.

PRESERVATION GROUP F (VO)			
PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	01002	.
BARIUM	01005	01007	264.0 µg/g
CADMIUM	01025	01027	148.0 µg/g
CHROMIUM	01030	01034	708.4 µg/g
CHROMIUM Hexavalent		01032	<.04 µg/g
COPPER	01040	01042	.
IRON	01046	01045	.
LEAD	01049	01051	1048.4 µg/g
MANGANESE	01056	01055	.
MERCURY	71890	71900	52 µg/g
NICKEL	01065	01067	.
SELENIUM	01145	01147	.
SILVER	01075	01077	.
ZINC	01090	01092	.
CALCIUM as Ca	00915	00916	. mg/l
MAGNESIUM as Mg	00925	00927	. mg/l
POTASSIUM	00935	00937	. mg/l
SODIUM	00930	00929	. mg/l

PRESERVATION GROUP G		
PARAMETER	TOTAL	MG/L
BORON	01022	. µg/l
BORON, Dissolved	01020	. µg/l
CHLORIDE	00940	.
COLOR	00080	Units
FLUORIDE	00951	.
Residue Filterable (TDS)	00515	.
Residue Non Filt (SS)	00530	.
Residue	00500	.
Residue Volatile	00505	.
Specific Conductance	00095	µmhos
SULFATE as SO_4	00945	.
SURFACTANTS MBAS as LAS	38260	.
TURBIDITY	00076	Units
PRESERVATION GROUP J		
PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS

Reese AFB

CHEMIST: LJJ LH EH DWB

REVIEWED BY

APPROVED BY: [signature]

D-15

CEHL FORM NOV 76 1 NON-POTABLE WATER ANALYSIS

0912

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NO
OL AA, USAF OEHL Kelly AFB, TX 78241	22675 - 22677 00008	15770055 00028

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION	1650630000-00009/270 STP EFFLUENT #1
5. DATE RECEIVED BY LAB	8-30-77
6. DATE ANALYSIS COMPLETED	13 Sept 77
1. SITE LOCATION NO	
9. FLOWRATE AT SITE 00058 GAL/MIN	353
10. WEATHER 00041	9
11. COLLECTION DATE/PERIOD	24Aug77,0800-2400
12. COLLECTORS NAME	TSgt Wedgeworth
13. SAMPLING TECHNIQUE	16 hr comp,dipped from final eff.
14. PHONE NUMBER	A/V 838-2663
15. REASON FOR SAMPLE SUBMISSION	NPDES #None,Routine local policy monitoring

ON-SITE ANALYTICAL RESULTS

16. WATER TEMP 00010	17. PH 00400 UNITS	18. DISS O2 00300 MG/L
26.8°C	7.3	4.1

19. RESULTS OF OTHER ON-SITE ANALYSES

ANALYSES REQUESTED AND RESULTS

PRESERVATION GROUP A

PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	86
Total Organic CARBON as C	00680	13

PRESERVATION GROUP B

PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	

PRESERVATION GROUP C

PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	
NITRATE as N Cd Reduct. Method	00620	
NITRITE as N	00615	
TOTAL KJELDAHL NITROGEN as N	00625	
PHOSPHORUS Ortho PO4 as P	70507	
PHOSPHORUS as P	00665	

PRESERVATION GROUP D

PARAMETER	TOTAL	MG/L
CYANIDE	00720	<.01
CYANIDE Free, Amenable to Cl_2	00722	

PRESERVATION GROUP E

PARAMETER	TOTAL	µG/L
PHENOLS	32730	

PRESERVATION GROUP F

PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	01002	
BARIUM	01005	01007	
CADMIUM	01025	01027	<10
CHROMIUM	01030	01034	<50
CHROMIUM Hexavalent		01032	<50
COPPER	01040	01042	<20
IRON	01046	01045	130
LEAD	01049	01051	<50
MANGANESE	01056	01055	67
MERCURY	71890	71900	<5
NICKEL	01065	01067	
SELENIUM	01145	01147	
SILVER	01075	01077	16
ZINC	01090	01092	<50
CALCIUM as Ca	00915	00916	MG/L
MAGNESIUM as Mg	00925	00927	MG/L
POTASSIUM	00935	00937	MG/L
SODIUM	00930	00929	MG/L

PRESERVATION GROUP G

PARAMETER	TOTAL	MG/L
BORON	01022	µG/L
BORON, Dissolved	01020	µG/L
CHLORIDE	00940	
COLOR	00080	Units
FLUORIDE	00951	
Residue Filterable (TDS)	00515	
Residue Non Filt (SS)	00530	
Residue	00500	
Residue Volatile	00505	
Specific Conductance	00095	µmhos
SULFATE as SO_4	00945	
SURFACTANTS MBAS as LAS	38260	
TURBIDITY	00076	Units

PRESERVATION GROUP J

PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS

ENVIRONMENTAL HEALTH SERVICE
USAF Hospital Reese/SGPM
Reese AFB,TX 79489

A/V 838-2608

CHEMIST: [signature]

REVIEWED BY

APPROVED BY: [signature]

OEHL FORM NOV 76 1

NON-POTABLE WATER ANALYSIS

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NO
OL AA, USAF OEHL Kelly AFB, TX 78241	22678 00005	13770056 00026

SAMPLE COLLECTION INFORMATION

5. DATE RECEIVED BY LAB	8-30-77
6. DATE ANALYSIS COMPLETED	13 Sept, 77
7. SITE DESCRIPTION	1650630000-00009/036 Polishing Lagoon EFF #2
8. SITE LOCATION NO	
9. FLOWRATE AT SITE (00056 GAL/MIN)	26
10. WEATHER (00041)	9
11. COLLECTION DATE/PERIOD	24 Aug77, 0800-1600
12. COLLECTORS NAME	SrA Gaynor
13. SAMPLING TECHNIQUE	8 hr comp, collected at outlet
14. PHONE NUMBER	A/V 838-2608
15. REASON FOR SAMPLE SUBMISSION	NPDES. None, Routine local policy monitoring

ON-SITE ANALYTICAL RESULTS

16. WATER TEMP (00010 °C)	17. PH (00400 UNITS)	18. DISS O_2 (00300 MG/L)
22	7.2	0.3

19. RESULTS OF OTHER ON-SITE ANALYSES

ANALYSES REQUESTED AND RESULTS

PRESERVATION GROUP A

PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	66
Total Organic CARBON as C	00680	33

PRESERVATION GROUP B

PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	

PRESERVATION GROUP C

PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	
NITRATE as N Cd Reduct. Method	00620	
NITRITE as N	00615	
TOTAL KJELDAHL NITROGEN as N	00625	
PHOSPHORUS Ortho PO4 as P	70507	
PHOSPHORUS as P	00665	

PRESERVATION GROUP D

PARAMETER	TOTAL	MG/L
CYANIDE	00720	
CYANIDE Free, Amenable to Cl_2	00722	

PRESERVATION GROUP E

PARAMETER	TOTAL	µG/L
PHENOLS	32730	

PRESERVATION GROUP F

PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	01002	
BARIUM	01005	01007	
CADMIUM	01025	01027	
CHROMIUM	01030	01034	
CHROMIUM Hexavalent		01032	
COPPER	01040	01042	
IRON	01046	01045	
LEAD	01049	01051	
MANGANESE	01056	01055	
MERCURY	71890	71900	
NICKEL	01065	01067	
SELENIUM	01145	01147	
SILVER	01075	01077	
ZINC	01090	01092	
CALCIUM as Ca	00915	00916	MG/L
MAGNESIUM as Mg	00925	00927	MG/L
POTASSIUM	00935	00937	MG/L
SODIUM	00930	00929	MG/L

PRESERVATION GROUP G

PARAMETER	TOTAL	MG/L
BORON	01022	µG/L
BORON, Dissolved	01020	µG/L
CHLORIDE	00940	
COLOR	00080	Units
FLUORIDE	00951	
Residue Filterable (TDS)	00515	
Residue Non Filt (SS)	00530	
Residue	00500	
Residue Volatile	00505	
Specific Conductance	00095	µmhos
SULFATE as SO_4	00945	
SURFACTANTS MBAS as LAS	38260	
TURBIDITY	00076	Units

PRESERVATION GROUP J

PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS

ENVIRONMENTAL HEALTH SERVICE
USAF Hospital Reese/SGPB
Reese AFB, Tx 79489

A/V 838-2608

CHEMIST

REVIEWED BY

APPROVED BY

OEHL FORM 1 NOV 76

NON-POTABLE WATER ANALYSIS

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NO
OL AA, USAF OEHL Kelly AFB,TX 78241	22679 - 22685 00008	13770057 00020

SAMPLE COLLECTION INFORMATION

Field	Entry
5. DATE RECEIVED BY LAB	8-30-77
6. DATE ANALYSIS COMPLETED	13 Sept. 77
7. SITE DESCRIPTION	1650630000-00009/000 IRRIGATION INTAKE #3
8. SITE LOCATION NO	
9. FLOWRATE AT SITE (00058 GAL/MIN)	No flow
10. WEATHER (00041)	9
11. COLLECTION DATE/PERIOD	24 Aug 77,0800-1600
12. COLLECTORS NAME	SrA Gaynor
13. SAMPLING TECHNIQUE	Grab sample @ surface
14. PHONE NUMBER	838-2608
15. REASON FOR SAMPLE SUBMISSION	NPDES # None. Routine local policy monitoring

ON-SITE ANALYTICAL RESULTS

16. WATER TEMP (00010 °C)	17. PH (00400 UNITS)	18. DISS O2 (00300 MG/L)
24.8	7.8	3.0

19. RESULTS OF OTHER ON-SITE ANALYSES

ANALYSES REQUESTED AND RESULTS

PRESERVATION GROUP A		
PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	113
Total Organic CARBON as C	00680	30

PRESERVATION GROUP B		
PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	<.3

PRESERVATION GROUP C		
PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	3.7
NITRATE as N Cd Reduct. Method	00620	0.2
NITRITE as N	00615	
TOTAL KJELDAHL NITROGEN as N	00625	
PHOSPHORUS Ortho PO4 as P	70507	1.2
PHOSPHORUS as P	00665	

PRESERVATION GROUP D		
PARAMETER	TOTAL	MG/L
CYANIDE	00720	<.01
CYANIDE Free, Amenable to Cl_2	00722	

PRESERVATION GROUP E		
PARAMETER	TOTAL	µG/L
PHENOLS	32730	<10

PRESERVATION GROUP F			
PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	01002	
BARIUM	01005	01007	
CADMIUM	01025	01027	<10
CHROMIUM	01030	01034	<50
CHROMIUM Hexavalent		01032	<50
COPPER	01040	01042	<20
IRON	01046	01045	880
LEAD	01049	01051	<50
MANGANESE	01056	01055	62
MERCURY	71890	71900	
NICKEL	01065	01067	
SELENIUM	01145	01147	
SILVER	01075	01077	<10
ZINC	01090	01092	<50
CALCIUM as Ca	00915	00916	mg/l
MAGNESIUM as Mg	00925	00927	mg/l
POTASSIUM	00935	00937	mg/l
SODIUM	00930	00929	mg/l

PRESERVATION GROUP G		
PARAMETER	TOTAL	MG/L
BORON	01022	µg/l
BORON, Dissolved	01020	µg/l
CHLORIDE	00940	43
COLOR	00080	Units
FLUORIDE	00951	
Residue Filterable (TDS)	00515	
Residue Non Filt (SS)	00530	
Residue	00500	
Residue Volatile	00505	
Specific Conductance	00095	µmhos
SULFATE as SO_4	00945	56
SURFACTANTS MBAS as LAS	38260	.55
TURBIDITY	00076	4.4 Units

PRESERVATION GROUP J		
PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS

ENVIRONMENTAL HEALTH SERVICE
USAF HOSPITAL REESE/SGPM
Reese AFB,TX 79489

CHEMIST

REVIEWED BY

APPROVED BY

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NO
OB AA,USAF OEHL Kelly AFB,TX 78241	22686-22692 00008	13770058 00028

SAMPLE COLLECTION INFORMATION

5. DATE RECEIVED BY LAB	8-30-77
6. DATE ANALYSIS COMPLETED	13 Sept. 77
7. SITE DESCRIPTION	1650490000-00009/000 INDUSTRIAL WASTE.INF #4
8. SITE LOCATION NO	
9. FLOWRATE AT SITE (00058 GAL/MIN)	8.6
10. WEATHER (00041)	9
11. COLLECTION DATE/PERIOD	0800-1600,24Aug77
12. COLLECTORS NAME	SrA Gaynor
13. SAMPLING TECHNIQUE	8 hr comp,captured at outlet
14. PHONE NUMBER	A/V 838-2608
15. REASON FOR SAMPLE SUBMISSION	NPDES # None, Routine local policy monitoring

ON-SITE ANALYTICAL RESULTS

16. WATER TEMP (00010 °C)	17. PH (00400 UNITS)	18. DISS O2 (00300 MG/L)
25	6.5	4.0

19. RESULTS OF OTHER ON-SITE ANALYSES

ANALYSES REQUESTED AND RESULTS

PRESERVATION GROUP A

PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	157.
Total Organic CARBON as C	00680	41.

PRESERVATION GROUP B

PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	.6

PRESERVATION GROUP C

PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	6.2
NITRATE as N Cd Reduct. Method	00620	0.7
NITRITE as N	00615	.
TOTAL KJELDAHL NITROGEN as N	00625	.
PHOSPHORUS Ortho PO4 as P	70507	0.6
PHOSPHORUS as P	00665	.

PRESERVATION GROUP D

PARAMETER	TOTAL	MG/L
CYANIDE	00720	<.01
CYANIDE Free, Amenable to Cl_2	00722	.

PRESERVATION GROUP E

PARAMETER	TOTAL	~~MG/L~~
PHENOLS	32730	425.

PRESERVATION GROUP F

PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	01002	.
BARIUM	01005	01007	.
CADMIUM	01025	01027	46
CHROMIUM	01030	01034	120
CHROMIUM Hexavalent		01032	<50
COPPER	01040	01042	<20
IRON	01046	01045	170
LEAD	01049	01051	<50
MANGANESE	01056	01055	59
MERCURY	71890	71900	.
NICKEL	01065	01067	.
SELENIUM	01145	01147	.
SILVER	01075	01077	<10
ZINC	01090	01092	70
CALCIUM as Ca	00915	00916	. mg/l
MAGNESIUM as Mg	00925	00927	. mg/l
POTASSIUM	00935	00937	. mg/l
SODIUM	00930	00929	. mg/l

PRESERVATION GROUP G

PARAMETER	TOTAL	MG/L
BORON	01022	. µg/l
BORON, Dissolved	01020	. µg/l
CHLORIDE	00940	4.
COLOR	00080	20 Units
FLUORIDE	00951	.4
Residue Filterable (TDS)	00515	.
Residue Non Filt (SS)	00530	.
Residue	00500	.
Residue Volatile	00505	.
Specific Conductance	00095	µmhos
SULFATE as SO_4	00945	39.
SURFACTANTS MBAS as LAS	38260	15.0
TURBIDITY	00076	3.2 Units

PRESERVATION GROUP J

PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS
ENVIRONMENTAL HEALTH SERVICE
USAF HOspital Reese/SGPM
ReeseAFB,TX 79489

CHEMIST: [illegible signatures] RB RCL
REVIEWED BY:
APPROVED BY: [signature]

OEHL FORM 1 NOV 74

NON-POTABLE WATER ANALYSIS

2. LABORATORY PERFORMING ANALYSIS
OL AA, USAF OEHL
Kelly AFB, TX 78241

3. LAB SAMPLE NUMBER
22693- 22697 00008

4. REQUESTOR SAMPLE NO
13770059 00029

SAMPLE COLLECTION INFORMATION

5. DATE RECEIVED BY LAB: 8-30-77

6. DATE ANALYSIS COMPLETED: 13 Sept. 77

7. SITE DESCRIPTION
16504950000-00009/000 INDUSTRIAL WASTE EFF#5

ON-SITE ANALYTICAL RESULTS

8. SITE LOCATION NO	9. FLOWRATE AT SITE	10. WEATHER 00041	16. WATER TEMP	17. PH	18. DISS O2
	No flow 00058 GAL/MIN	9	23 00010 °C	7.1 00400 UNITS	6.0 00300 MG/L

11. COLLECTION DATE/PERIOD: 24 Aug77, 0800-1600

12. COLLECTORS NAME: SrA Gaynor

13. SAMPLING TECHNIQUE: 8 hr comp., dipped from surface

14. PHONE NUMBER: A/V 838-2608

15. REASON FOR SAMPLE SUBMISSION
NPDES: None, Routine local policy monitoring

19. RESULTS OF OTHER ON-SITE ANALYSES

ANALYSES REQUESTED AND RESULTS

PRESERVATION GROUP A		
PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	86
Total Organic CARBON as C	00680	22
PRESERVATION GROUP B		
PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	<.3
PRESERVATION GROUP C		
PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	<.2
NITRATE as N Cd Reduct. Method	00620	0.3
NITRITE as N	00615	
TOTAL KJELDAHL NITROGEN as N	00625	
PHOSPHORUS Ortho PO4 as P	70507	<.1
PHOSPHORUS as P	00665	
PRESERVATION GROUP D		
PARAMETER	TOTAL	MG/L
CYANIDE	00720	<.01
CYANIDE Free, Amenable to Cl_2	00722	
PRESERVATION GROUP E		
PARAMETER	TOTAL	µG/L
PHENOLS	32730	<10

PRESERVATION GROUP F			
PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	01002	
BARIUM	01005	01007	
CADMIUM	01025	01027	<10
CHROMIUM	01030	01034	<50
CHROMIUM Hexavalent		01032	<50
COPPER	01040	01042	<20
IRON	01046	01045	290
LEAD	01049	01051	<50
MANGANESE	01056	01055	10,700
MERCURY	71890	71900	
NICKEL	01065	01067	
SELENIUM	01145	01147	
SILVER	01075	01077	<10
ZINC	01090	01092	<50
CALCIUM as Ca	00915	00916	MG/L
MAGNESIUM as Mg	00925	00927	MG/L
POTASSIUM	00935	00937	MG/L
SODIUM	00930	00929	MG/L

PRESERVATION GROUP G		
PARAMETER	TOTAL	MG/L
BORON	01022	µG/L
BORON, Dissolved	01020	µG/L
CHLORIDE	00940	9
COLOR	00080	40 Units
FLUORIDE	00951	
Residue Filterable (TDS)	00515	
Residue Non Filt (SS)	00530	
Residue	00500	
Residue Volatile	00505	
Specific Conductance	00095	µmhos
SULFATE as SO_4	00945	
SURFACTANTS MBAS as LAS	38260	
TURBIDITY	00070	Units
PRESERVATION GROUP J		
PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS
ENVIRONMENTAL HEALTH SERVICES
USAF Hospital Reese/SGPM
Reese AFB, TX 79489

CHEMIST: [signature]

REVIEWED BY

APPROVED BY: [signature]

OEHL JUN 74 — NON-POTABLE WATER ANALYSIS

Industrial Waste Lake Samples

PHR 2/12

E.P. TOXICITY ANALYSIS

Texas Department of Health
BUREAU OF SOLID WASTE MANAGEMENT
Austin, Texas

(Begin)
I certify these samples were collected and sealed by me at __:__ __.m. on __/__/__ and remained in my custody until transferred to ________ at __:__ __.m. on __/__/__.

X ________________
(Signature)

SAMPLE DESCRIPTION:

TDH Region No. 2 County Lubbock

Site Name Reese AFB

TDH Permit/Registration No. 62005

Sample No. 2 Seal No. ________

☐ Surface Water Sample OR ☐ Monitor Well No. ________

Comments/Warnings
Sludge from lake
near inlet point of West Side

DATES: Sample Collected 6/2/83

Laboratory Received: 6/3/83 & 8/3/83

Laboratory Reported: SEP 22 1983

TDH/BSWM Received: SEP 23 1983

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ________ at __:__ __.m. on __/__/__.

X ________________
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ________ at __:__ __.m. on __/__/__.

X ________________
(Signature)

LABORATORY ANALYSES

I. Heavy Metals

Arsenic	0.01	mg/L
Barium	<0.5	mg/L
Cadmium	0.24	mg/L
Chromium	< 0.04	mg/L
Lead	<0.05	mg/L
Mercury	<0.0002	mg/L
Selenium	<0.004	mg/L
Silver	<0.01	mg/L

II. Pesticides

Endrin	<0.0002	mg/L
Lindane	<0.00003	mg/L
Methoxychlor	<0.0005	mg/L
Toxaphene	<0.005	mg/L
2,4-D	<0.020	mg/L
2,4,5-TP Silvex	<0.0[illegible]5	mg/L

LABORATORY NUMBER:
E83-257

TEXAS DEPT. OF HEALTH
1983 SEP 23 AM 11:46
BUREAU OF SOLID WASTE MANAGEMENT

I certify these samples were continuously in my custody from the time of receipt listed above until the completion of laboratory analyses on 9/9/83

X [signature]
(Signature)

SEP 23 1983
cc PHR
cc File
cc DBM
LWM

(Begin)

(2)

E.P. TOXICITY ANALYSIS

Texas Department of Health
BUREAU OF SOLID WASTE MANAGEMENT
Austin, Texas

SEP 2

I certify these samples were collected and sealed by me at __:__ __.m. on __/__/__ and remained in my custody until transferred to ________ at __:__ __.m. on __/__/__.

X________
(Signature)

SAMPLE DESCRIPTION:

TDH Region No. 2 County Lubbock

Site Name Reese AFB

TDH Permit/Registration No. 62005

Sample No. 7C Seal No. ________

☐ Surface Water Sample OR ☐ Monitor Well No. ________

Comments/Warnings
Sludge from lake bottom
N.E. SECTOR

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ________ at __:__ __.m. on __/__/__.

X________
(Signature)

DATES: Sample Collected 6-2-83

Laboratory Received: 6-3-83 8/3/83

Laboratory Reported: AUG 29 1983

TDH/BSWM Received: AUG 31 1983

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ________ at __:__ __.m. on __/__/__.

X________
(Signature)

LABORATORY ANALYSES

I. Heavy Metals

Arsenic	0.032	mg/L
Barium	1.2	mg/L
Cadmium	0.18	mg/L
Chromium	0.02	mg/L
Lead	0.13	mg/L
Mercury	<0.0002	mg/L
Selenium	<0.008	mg/L
Silver	<0.01	mg/L

II. Pesticides

Endrin		mg/L
Lindane		mg/L
Methoxychlor		mg/L
Toxaphene		mg/L
2,4-D		mg/L
2,4,5-TP Silvex		mg/L

TEXAS DEPT. OF HEALTH
BUR. OF SOLID WASTE MANAGEMENT
1983 AUG 30 AM 11 24

LABORATORY NUMBER:
ES3-254

I certify these samples were continuously in my custody from the time of receipt listed above until the completion of laboratory analyses on 8/29/83

X [signature]
(Signature)

AUG 31 1983

(2)

E.P. TOXICITY ANALYSIS

Texas Department of Health
BUREAU OF SOLID WASTE MANAGEMENT
Austin, Texas

SAMPLE DESCRIPTION:
TDH Region No. 2 County Lubbock
Site Name Reese AFB
TDH Permit/Registration No. 62005
Sample No. 8C Seal No. ____
☐ Surface Water Sample OR ☐ Monitor Well No. ____
Comments/Warnings
Sludge from lake bottom

DATES: Sample Collected 6-2-83
Laboratory Received: 6-3-83 & 8/3/83
Laboratory Reported: AUG 29 1983
TDH/BSWM Received: AUG 31 1983

(Begin)
I certify these samples were collected and sealed by me at __:__ __.m. on __/__/__ and remained in my custody until transferred to ____ at __:__ __.m. on __/__/__.

X ____
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on __/__/__.

X ____
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on __/__/__.

X ____
(Signature)

LABORATORY ANALYSES

I. Heavy Metals

Arsenic	0.023	mg/L
Barium	1.7	mg/L
Cadmium	0.39	mg/L
Chromium	0.02	mg/L
Lead	0.39	mg/L
Mercury	<0.0002	mg/L
Selenium	<0.008	mg/L
Silver	<0.01	mg/L

II. Pesticides

Endrin		mg/L
Lindane		mg/L
Methoxychlor		mg/L
Toxaphene		mg/L
2,4-D		mg/L
2,4,5-TP Silvex		mg/L

TEXAS DEPT. OF HEALTH
1983 AUG 30 AM 11:28
BUR. OF SOLID WASTE MANAGEMENT

LABORATORY NUMBER: E53-256

I certify these samples were continuously in my custody from the time of receipt listed above until the completion of laboratory analyses on 8/29/83

X ____
(Signature)

AUG 31 1983
cc PHR 2 Com

PHR 2

E.P. TOXICITY ANALYSIS

Texas Department of Health
BUREAU OF SOLID WASTE MANAGEMENT
Austin, Texas

SAMPLE DESCRIPTION:

TDH Region No. 2 County Lubbock

Site Name Reese AFB

TDH Permit/Registration No. 62005

Sample No. 1 Seal No. ____

☐ Surface Water Sample OR ☐ Monitor Well No. ____

Comments/Warnings ____

soil sample from inlet ditch

DATES: Sample Collected 6-2-83

Laboratory Received: 6-3-83 8/3/83

Laboratory Reported: SEP 08 1983

TDH/BSWM Received: SEP 08 1983

(Begin)
I certify these samples were collected and sealed by me at __:__ __.m. on _/_/_ and remained in my custody until transferred to ____ at __:__ __.m. on _/_/_

X ____
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on _/_/_.

X ____
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on _/_/_.

X ____
(Signature)

LABORATORY ANALYSES

I. Heavy Metals

Metal	Result	Unit
Arsenic	<0.01	mg/L
Barium	1.2	mg/L
Cadmium	<0.01	mg/L
Chromium	0.04	mg/L
Lead	0.24	mg/L
Mercury	<0.0002	mg/L
Selenium	<0.008	mg/L
Silver	<0.01	mg/L

II. Pesticides

Pesticide	Result	Unit
Endrin		mg/L
Lindane		mg/L
Methoxychlor		mg/L
Toxaphene		mg/L
2,4-D		mg/L
2,4,5-TP Silvex		mg/L

LABORATORY NUMBER:

E53-248

I certify these samples were continuously in my custody from the time of receipt listed above until the completion of laboratory analyses on 9/8/83

X [signature]
(Signature)

SEP 13 1983
cc PHR 2
LFM

REGION. 2

E.P. TOXICITY ANALYSIS

Texas Department of Health
BUREAU OF SOLID WASTE MANAGEMENT
Austin, Texas

(Begin)
I certify these samples were collected and sealed by me at __:__ __.m. on __/__/__ and remained in my custody until transferred to ________ at __:__ __.m. on __/__/__.

X ________
(Signature)

SAMPLE DESCRIPTION:

TDH Region No. 2 County Lubbock

Site Name Reese AFB

TDH Permit/Registration No. 62005

Sample No. 1 Seal No. ________

☐ Surface Water Sample OR ☐ Monitor Well No. ________

Comments/Warnings

soil sample from inlet ditch

DATES: Sample Collected 6-2-83

Laboratory Received: 6-3-83 8/3/83

Laboratory Reported: ~~SEP 08 1983~~

TDH/BSWM Received: SEP 08 1983

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ________ at __:__ __.m. on __/__/__.

X ________
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ________ at __:__ __.m. on __/__/__.

X ________
(Signature)

LABORATORY ANALYSES

I. Heavy Metals

Arsenic	<0.01	mg/L
Barium	1.2	mg/L
Cadmium	<0.01	mg/L
Chromium	0.04	mg/L
Lead	0.24	mg/L
Mercury	<0.0002	mg/L
Selenium	<0.008	mg/L
Silver	<0.01	mg/L

II. Pesticides

Endrin		mg/L
Lindane		mg/L
Methoxychlor		mg/L
Toxaphene		mg/L
2,4-D		mg/L
2,4,5-TP Silvex		mg/L

LABORATORY NUMBER:

E53-248

I certify these samples were continuously in my custody from the time of receipt listed above until the completion of laboratory analyses on 9/8/83

X [signature]
(Signature)

SEP 13 1983
cc PHR2
LEM

PHR 2

E.P. TOXICITY ANALYSIS

Texas Department of Health
BUREAU OF SOLID WASTE MANAGEMENT
Austin, Texas

SEP 1 9 1983

SAMPLE DESCRIPTION:

TDH Region No. 2 County Lubbock

Site Name REESE AFB

TDH Permit/Registration No. 62005

Sample No. 3 Seal No. ____

☐ Surface Water Sample OR ☐ Monitor Well No. ____

Comments/Warnings

soil sample from discharge ditch

DATES: Sample Collected 6/2/83

Laboratory Received: 6/3/83 8/3/83

Laboratory Reported: SEP 0 9 1983

TDH/BSWM Received: 1983

(Begin)
I certify these samples were collected and sealed by me at __:__ __.m. on __/__/__ and remained in my custody until transferred to ____ at __:__ __.m. on __/__/__.

X ____
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on __/__/__.

X ____
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on __/__/__.

X ____
(Signature)

LABORATORY ANALYSES

I. Heavy Metals

Arsenic	<0.01	mg/L
Barium	1.1	mg/L
Cadmium	<0.01	mg/L
Chromium	0.02	mg/L
Lead	<0.05	mg/L
Mercury	<0.0002	mg/L
Selenium	<0.008	mg/L
Silver	0.02	mg/L

II. Pesticides

Endrin	<0.0002	mg/L
Lindane	<0.00003	mg/L
Methoxychlor	<0.0005	mg/L
Toxaphene	<0.005	mg/L
2,4-D	<0.02	mg/L
2,4,5-TP Silvex	<0.005	mg/L

LABORATORY NUMBER:
E53-255

TEXAS DEPT. OF HEALTH
1983 SEP 14 PM 3 14
DIV. OF SOLID WASTE MANAGEMENT

I certify these samples were continuously in my custody from the time of receipt listed above until the completion of laboratory analyses on 9/2/83

X [signature]
(Signature)

CC PHR 2 LEM
cc FILE

SPECIAL SAMPLES: ORGANICS & OTHERS

Texas Department of Health
BUREAU OF SOLID WASTE MANAGEMENT
Austin, Texas

SAMPLE DESCRIPTION:

TDH Region No. 2 County Lubbock

Site Name REESE A.F.B.

TDH Permit/Registration No. 62005

Sample No. 7C Seal No.

~~Surface Water Sample OR~~ ~~Monitor Well No.~~

Comments/Warnings

Sludge from Lake Bottom

DATES: Sample Collected 6-2-83

Laboratory Received: 6-3-83

Laboratory Reported: JUN 28 1983

TDH/BSWM Received: JUN 28 1983

(Begin)
I certify these samples were collected and sealed by me at __:__ __.m. on __/__/__ and remained in my custody until transferred to ____________ at __:__ __.m. on __/__/__.

X ____________
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____________ at __:__ __.m. on __/__/__.

X ____________
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____________ at __:__ __.m. on __/__/__.

X ____________
(Signature)

LABORATORY ANALYSES ON SLUDGE

Analysis Required:

- [ ] Priority Pollutants GC-MS

Sample: 1 full quart/Liter in glass with teflon or aluminum lid liner.

- [x] Volatile Organics (or TOX)

~~*Sample: 2 full 40ml vials with special*~~ *cap* ~~*and teflon septum*~~

Trace of benzene <10 ppb

TEXAS DEPT. OF HEALTH
1983 JUN 29 AM 11:23
DIV. OF SOLID WASTE MANAGEMENT

LABORATORY NUMBER: ES3-254

I certify these samples were continuously in my custody from the time of receipt listed above until the completion of laboratory analyses on __/__/__.

X ____________
(Signature)

JUL 29 1983

SPECIAL SAMPLES: ORGANICS & OTHERS

Texas Department of Health
BUREAU OF SOLID WASTE MANAGEMENT
Austin, Texas

SAMPLE DESCRIPTION:

TDH Region No. 2 County LUBBOCK

Site Name REESE AFB

TDH Permit/Registration No. 62005

Sample No. 8C Seal No. ____

☐ ~~Surface Water Sample OR~~ ☐ ~~Monitor Well~~ No. ____

Comments/Warnings ____

LAKE Bottom Sludge

DATES: Sample Collected 6/2/83

Laboratory Received: 6/3/83

Laboratory Reported: JUN 28 1983

TDH/BSWM Received: JUN 29 1983

(Begin)

I certify these samples were collected and sealed by me at __:__ __.m. on __/__/__ and remained in my custody until transferred to ____ at __:__ __.m. on __/__/__.

X____
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on __/__/__.

X____
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on __/__/__.

X____
(Signature)

LABORATORY ANALYSES Sludge

Analysis Required:

☐ Priority Pollutants GC-MS

Sample: 1 full quart/Liter in glass with teflon or aluminum lid liner.

☐ Volatile Organics (or TOX)

~~*Sample: 2 full 40ml vials with special cap and teflon septum.*~~

Contains Hydrocarbons in ppm range predominately unsaturated Hydrocarbons

TEXAS DEPT. OF HEALTH
1983 JUN 29 AM 11:23
DIV. OF SOLID WASTE MANAGEMENT

LABORATORY NUMBER: ES3-256

I certify these samples were continuously in my custody from the time of receipt listed above until the completion of laboratory analyses on __/__/__.

X____
(Signature)

JUL 29 1983

~~GROUND~~WATER ANALYSIS REQUEST: Part II

Texas Department of Health
BUREAU OF SOLID WASTE MANAGEMENT
Austin, Texas

SAMPLE DESCRIPTION

TDH Region No. 2 County LUBBOCK

Site Name REESE AFB

TDH Permit/Registration No. ____

Sample No. 5 Seal No. ____

☐ Surface Water Sample OR ☐ Monitor Well No. ____

Comments/Warnings DISCHARGE FROM OIL/WATER SEPARATOR

DATES: Sample Collected: 6-2-83

Laboratory Received: [illegible]

Laboratory Reported: JUL 21 1983

TDH/BSWM Received: JUL 22 1983

(Begin)
I certify these samples were collected and sealed by me at 1:15 P.m. on 6/2/83 and remained in my custody until transferred to TDH LAB at __:__ __.m. on 6/3/83.

x D.S. McArthur
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on __/__/__.

x ____
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on __/__/__.

x ____
(Signature)

NOTE: Specify analysis required

LABORATORY ANALYSIS RESULTS

☒ Heavy Metals

Sample Required: 1 full quart/Liter in plastic with 5 ml Nitric Acid added ✓

Arsenic..........	<0.01	mg/L
Barium...........	<0.5	mg/L
Cadmium..........	0.22	mg/L
Chromium.........	1.2	mg/L
Copper...........	1.1	mg/L
Iron.............	0.48	mg/L
Lead.............	0.18	mg/L
Manganese........	0.10	mg/L
Mercury..........	<0.0008	mg/L
Selenium.........	<0.004	mg/L
Silver...........	<0.03	mg/L
Zinc.............	0.30	mg/L
Nickel.......	0.10	mg/L

LABORATORY NUMBER: E83-252

☐ Pesticides

Sample Required: 1 full quart/Liter in glass with teflon/ Aluminum lid liner

~~Endrin..................~~		mg/L
~~Lindane.................~~		mg/L
~~Methoxychlor............~~		mg/L
~~Toxaphene...............~~		mg/L
~~2,4-D...................~~		mg/L
~~2,4,5-TP................~~		mg/L
~~Other:~~		

I certify these samples were continuously in my custody from the time of receipt listed above until the completion of laboratory analyses on 7/11/83

x Sharon DuBois
(Signature)

TEXAS DEPT. OF HEALTH
BUREAU OF SOLID WASTE MANAGEMENT
1983 JUL 22 PM 1:47

JUL 29 1983

2/12

SPECIAL SAMPLES: ORGANICS & OTHERS

Texas Department of Health
BUREAU OF SOLID WASTE MANAGEMENT
Austin, Texas

SAMPLE DESCRIPTION:

TDH Region No. 2 County LUBBOCK

Site Name REESE AFB

TDH Permit/Registration No. 62005

Sample No. 8 Seal No. ____

☒ Surface Water Sample OR ☐ Monitor Well No. ____

Comments/Warnings LAKE SAMPLE

METHYLENE CHLORIDE SUSPECTED

DATES: Sample Collected 6-2-83

Laboratory Received: ____

Laboratory Reported: JUN 1 6 1983

TDH/BSWM Received: JUN 1 7 1983

(Begin)
I certify these samples were collected and sealed by me at 1:30 P.m. on 6/2/83 and remained in my custody until transferred to TDH LAB at __:__ __.m. on 6/3/83.

X D.S. McArthur
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on __/__/__.

X____
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on __/__/__.

X____
(Signature)

LABORATORY ANALYSES

Analysis Required:

☐ Priority Pollutants GC-MS
Sample: 1 full quart/Liter in glass with teflon or aluminum lid liner.

☒ Volatile Organics (or TOX)
Sample: 2 full 40ml vials with special cap and teflon septum.

Tetrachloroethylene detected = 440 µg/L

TEXAS DEPT. OF HEALTH
1983 JUN 17 AM 8 34
DIV. OF SOLID WASTE MANAGEMENT

LABORATORY NUMBER: E53-250

I certify these samples were continuously in my custody from the time of receipt listed above until the completion of laboratory analyses on __/__/__.

X____
(Signature)

JUN 1 7 1983

2/12

SPECIAL SAMPLES: ORGANICS & OTHERS

Texas Department of Health
BUREAU OF SOLID WASTE MANAGEMENT
Austin, Texas

SAMPLE DESCRIPTION:

TDH Region No. 2 County LUBBOCK

Site Name REESE AFB

TDH Permit/Registration No. 62005

Sample No. 7 Seal No. ____

☒ Surface Water Sample OR ☐ Monitor Well No. ____

Comments/Warnings LAKE SAMPLE
METHYLENE CHLORIDE SUSPECTED

DATES: Sample Collected 6-2-83

Laboratory Received: ____

Laboratory Reported: JUN 16 1983

TDH/BSWM Received: JUN 17 1983

(Begin)
I certify these samples were collected and sealed by me at 1:30 P.m. on 6/2/83 and remained in my custody until transferred to TDH LAB at __:__ __.m. on 6/3/83.

X D. M. Arthur
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on __/__/__.

X ____
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on __/__/__.

X ____
(Signature)

LABORATORY ANALYSES

Analysis Required:

☐ Priority Pollutants GC-MS

Sample: 1 full quart/Liter in glass with teflon or aluminum lid liner.

☒ Volatile Organics (or TOX)

Sample: 2 full 40ml vials with special cap and teflon septum.

tetrachloroethylene detected = 360 µg/l

TEXAS DEPT. OF HEALTH
1983 JUN 17 AM 8 34
DIV. OF SOLID WASTE MANAGEMENT

LABORATORY NUMBER: E83-251

I certify these samples were continuously in my custody from the time of receipt listed above until the completion of laboratory analyses on __/__/__.

X ____
(Signature)

2/12

SPECIAL SAMPLES: ORGANICS & OTHERS

Texas Department of Health
BUREAU OF SOLID WASTE MANAGEMENT
Austin, Texas

SAMPLE DESCRIPTION:
TDH Region No. 2 County LUBBOCK
Site Name REESE AFB
TDH Permit/Registration No. 62005
Sample No. 6 Seal No. ____
☒ Surface Water Sample OR ☐ Monitor Well No. ____
Comments/Warnings ____
METHYLENE CHLORIDE SUSPECTED

LAKE INLET STREAM
DATES: Sample Collected 6-2-83
Laboratory Received: ____
Laboratory Reported: JUN 16 1983
TDH/BSWM Received: JUN 17 1983

(Begin)
I certify these samples were collected and sealed by me at 2:00 P.m. on 6/2/83 and remained in my custody until transferred to TDH LAB at __:__ __.m. on 6/3/83.

X [signature]
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on _/_/_.

X ____
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ____ at __:__ __.m. on _/_/_.

X ____
(Signature)

LABORATORY ANALYSES

Analysis Required:

☐ Priority Pollutants GC-MS

Sample: 1 full quart/Liter in glass with teflon or aluminum lid liner.

☒ Volatile Organics (or TOX)

Sample: 2 full 40ml vials with special cap and teflon septum.

GC/MS
Methylene chloride ≅ 3000 μg/L
Methyl Ethyl Ketone ≅ 9,000 μg/L
1,1,1-Trichloroethane ≅ 100 μg/L
Tetrachloroethylene ≅ 300 μg/L

TEXAS DEPT. OF HEALTH
1983 JUN 17 AM 8:34
BUR OF SOLID WASTE MANAGEMENT

LABORATORY NUMBER: E83-247

I certify these samples were continuously in my custody from the time of receipt listed above until the completion of laboratory analyses on _/_/_.

X ____
(Signature)

2/12

SPECIAL SAMPLES: ORGANICS & OTHERS

Texas Department of Health
BUREAU OF SOLID WASTE MANAGEMENT
Austin, Texas

SAMPLE DESCRIPTION:

TDH Region No. 2 County LUBBOCK

Site Name REESE AFB

TDH Permit/Registration No. 62005

Sample No. 5 Seal No. ______

[X] Surface Water Sample OR [ ] Monitor Well No. ______

Comments/Warnings
METHYLENE CHLORIDE SUSPECTED

(OIL/WATER SEPARATOR DISCHARGE)

DATES: Sample Collected 6-2-83

Laboratory Received: ______

Laboratory Reported: JUN 16 1983

TDH/BSWM Received: JUN 17 1983

(Begin)
I certify these samples were collected and sealed by me at 1:15 P.m. on 6/2/83 and remained in my custody until transferred to TDH LAB at __:__ __.m. on 6/3/83.

X D.S. McArthur
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ______ at __:__ __.m. on __/__/__.

X ______
(Signature)

I certify these ___ samples were continuously in my custody from the time of receipt listed above until transferred to ______ at __:__ __.m. on __/__/__.

X ______
(Signature)

LABORATORY ANALYSES

Analysis Required:

[ ] Priority Pollutants GC-MS
Sample: 1 full quart/Liter in glass with teflon or aluminum lid liner.

[X] Volatile Organics (or TOX)
Sample: 2 full 40ml vials with special cap and teflon septum.

Toluene

GC/MS

Methylene chloride	≅ 9000 µg/L
Methyl Ethyl ketone	≅ 13,000 µg/L
1,1,1-Trichloroethane	≅ 1300 µg/L
Tetrachloroethylene	≅ 400 µg/L
Toluene	≅ 90 µg/L

TEXAS DEPT. OF HEALTH
1983 JUN 17 AM 8 34
BUREAU OF SOLID WASTE MANAGEMENT

LABORATORY NUMBER: E83-249

I certify these samples were continuously in my custody from the time of receipt listed above until the completion of laboratory analyses on __/__/__.

X ______
(Signature)

APPENDIX E

Inventory of POL Storage Tanks
on Reese AFB

TABLE E-1. STORAGE TANKS OF LESS THAN 1000 GALLONS CAPACITY

Facility Number	Product	Capacity (gal)	Description
20 (Comm)	Diesel	600	U
3146 (Comm-trans)	"	250	S
3147 (Comm-rec'r)	"	250	S
3171 (Gen plt)	"	275	U
3179 (Base Ops)	"	280	U
3110 (Control Tower)	"	285	U
3153 (NAVAID Shop)	"	275	U
3500 (CE Oper)	"	300	U
3553 (CE Control)	"	275	U
2001 (Waste Treatment)	"	500	U
3112 (Gen Plt)	"	275	U
3122 (VORTAC)	"	500	U
3131 (ILS-LOC)	"	110	U
3133 (ILS-GS)	"	110	U
3134 (ILS-Marker)	"	110	U
3136 (ILS-GS)	"	110	U
3137 (ILS-LOC)	"	110	U
3140 (Test Cell)	JP-4	500	U
3160 (Fuel Maint)	JP-4	500	U
784-5 (POL)	Kerosene	585	U

U = underground
S - surface or aboveground

SOURCE: Reese 705.

TABLE E-2. CUMULATIVE FUELS STORAGE CAPACITY

		Cumulative Volume (gal)
JP-4		
4 Surface tanks > 10,000 gal. ea.	904,434	
1 Surface tank 1,000-10,000 gal.	2,300	
1 Underground tank 1,000-10,000 gal.	1,000	
2 Underground tanks < 1,000 gal. ea.	1,000	
TOTAL VOLUME		907,134
Diesel		
2 Underground tanks > 10,000 gal. ea.	24,400	
3 Underground tanks 1,000-10,000 gal/ea.	5,000	
17 Underground tanks < 1,000 gal. ea.	4,640	
2 Surface tanks < 1,000 gal. ea.	500	
TOTAL VOLUME		34,540
MOGAS		
5 Underground tanks > 10,000 gal. ea.	54,400	
4 Underground tanks 1,000-10,000 gal. ea.	12,000	
TOTAL VOLUME		66,400
Kerosene		
1 Underground tank < 1,000 gal.	585	
TOTAL VOLUME		585
Inactive Storage Tanks		
4 Underground tanks* > 10,000 gal. ea.	99,960	
TOTAL VOLUME		99,960

* These tanks are "pickled", i.e., filled with preservative solution; prior to approximately 1977, they contained MOGAS.

TABLE E-3. STORAGE TANKS OF 10,000 GALLONS OR GREATER CAPACITY

Facility Number	Product	Capacity (gal)	Description[b]	Date Installed[c]
783-13 (POL)	Inactive[a]	24,990	U, H, W	1942
783-14 (POL)	Inactive	24,990	U, H, W	1942
783-15 (POL)	Inactive	24,990	U, H, W	1942
783-16 (POL)	Inactive	24,990	U, H, W	1942
784-1 (POL)	Diesel	12,200	U, H, W	1952
784-2 (POL)	Diesel	12,200	U, H, W	1952
784-3 (POL)	MOGAS	12,200	U, H, W	1952
784-4 (POL)	MOGAS	12,200	U, H, W	1952
791 (POL)	JP-4	100,706	SD, Fx, W	1942
792 (POL)	JP-4	87,700	SD, Fx, W	1942
794 (POL)	JP-4	87,700	SD, Fx, W	1955
795 (POL)	JP-4	628,328	SD, Fl, W	1960
450 (BX Svc Stn)	MOGAS	10,000	U	N/A
450	MOGAS	10,000	U	N/A
450	MOGAS	10,000	U	N/A

[a] Filled with preservative solution.

[b] U - underground
H - horizontal cylinder
W - welded steel
S - surface or above ground
D - diked
Fx - fixed roof
Fl - floating roof

[c] Most small and medium capacity tanks are less than 20 years old (personal communication with Capt. Gene Smith).

SOURCE: TAB A-1, Reese Plan 705.

TABLE E-4. STORAGE TANKS OF 1000-10,000 GALLONS CAPACITY

Facility	Product	Capacity (gal)	Description
1173 (LOX storage)	LOX	5000	S
1173	LOX	2000	S
1300 (hospital)	Diesel	3000	U
3170 (fire training)	JP-4	2300	S
3181 (pump station)	Diesel	1000	U
3141 (veh. fl. stn.)	MOGAS	1000	U
3141 (veh. fl. stn.)	JP-4	1000	U
3142 (veh. fl. stn.)	MOGAS	5000	U
3142 (veh. fl. stn.)	MOGAS	5000	U
Terry Co. Aux. Fld.	MOGAS	1000	U
Terry Co. Aux. Fld.)	Diesel	1000	U

U = ungerground

S = surface or aboveground.

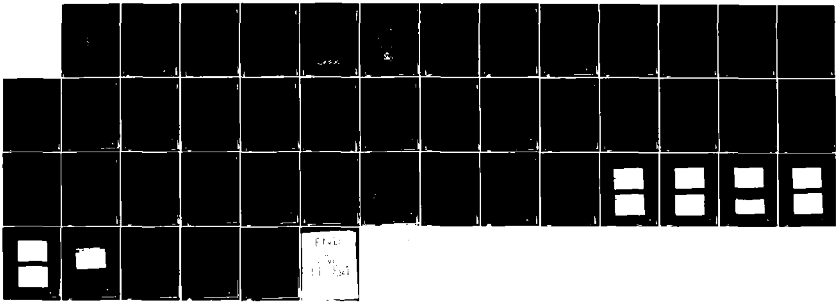
SOURCE: Reese Plan 705.

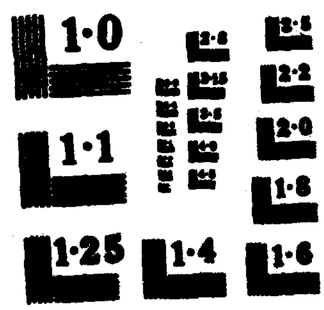
APPENDIX F

Inventory of Hazardous Materials
on Reese AFB

AD A144 351 INSTALLATION RESTORATION PROGRAM PHASE I RECORDS SEARCH 3/3
REESE AFB TEXAS(U) RADIAN CORP AUSTIN TX JUN 84
DCN 84 227 001 01 F08637 83 G 0008

UNCLASSIFIED F/G 13/2 NL




1·0
1·1
1·25
1·4
1·6
1·8
2·0
2·2
2·5

PESTICIDES USED BY ENTOMOLOGY SHOP, REESE AFB

Trade Name	Quantity used/yr.
Avitrol	small
Bait Block	15 lb.
Balan	*
Baygan Powder	10 lb.
Chlorodane	50?
Cythion	10 gal.
D-Phenothrin	48 cans
Daconil 2787	8 gal.
Dacthal W-50	50 lb.
Dacthal W-75	20 lb.
Dalchal	20 gal.
Diazinon 2D	10 lb.
Diazinon 4E	20 gal.
Deoreranı	1 gal.
Dowpon M	300 lb.
Durban 4E	5 gal.
Dursban Fog	75 gal.
Ficam	*
GB 1102	10 lb.
Kromad (Cd salt)	300 lb.
Malathion	100?
Methyl Bromide	*
Monuron	400 lb.
PPB Moth Crystals	4 lb.
Pramitol 5 PS	30 lb.
Repellent	72 cans
Roundup	*
Sevin	200 lb.
SBP-1382-40 WP	*

(Continued)

PESTICIDES USED BY ENTOMOLOGY SHOP, REESE AFB
(Continued)

Trade Name	Quantity used/yr.
Super Dal-E-Rad Calar	*
Talon	*
Tenocil	*
Tersan SP	*
Trex-son	1 gal.
Tuperson	4?
Warfarin	15 lb.
Wasp freeze	24 cans
2,4D Amine	20 gal.

* Data not available.

HAZARDOUS MATERIALS USED BY USAF HOSPITAL, REESE AFB

Substance Name	Quantity Used/yr.
Pro Fix Aerosol Cytology Fixative	108 oz.
CAMCO Quick Stain	64 oz.
Isopropyl Alcohol	115 gal.
Acetone ACS	4 pints
Methanol ACS	7 pints
Sulfuric Acis	1 pint
Silver Alloy Mercury Capsules	3000 capsules
Silver Alloy Powder Mercury Capsules	1500 capsules

MAJOR COMPONENTS OF JP-4 AVIATION FUEL

Fuel Component	Percent by Weight	Fuel Component	Percent by Weight
[illegible]	0.12	p-Xylene	0.35
[illegible]	0.66	3,4-Dimethylheptane	0.43
[illegible]	1.06	4-Ethylheptane	0.18
[illegible]	0.10	4-Methyloctane	0.86
[illegible]	1.28	2-Methyloctane	0.88
[illegible]	0.80	3-Methyloctane	0.79
[illegible]	2.21	o-Xylene	1.01
[illegible]	1.16	1-Methyl-4-ethylcyclohexane	0.48
[illegible]	0.25	n-Nonane	2.25
[illegible]	0.30	Isopropylbenzene	0.30
[illegible]	1.26	n-Propylbenzene	0.71
[illegible]	2.35	1-Methyl-3-ethylbenzene	0.49
[illegible]	1.97	1-Methyl-4-ethylbenzene	0.43
[illegible]	0.36	1,3,5-Trimethylbenzene	0.42
[illegible]	0.34	1-Methyl-2-ethylbenzene	0.23
[illegible]	0.54	1,2,4-Trimethylbenzene	1.01
[illegible]	3.67	n-Decane	2.16
[illegible]	2.27	n-Butylcyclohexane	0.70
[illegible]	0.24	1,3-Diethylbenzene	0.46
[illegible]	0.26	1-Methyl-4-propylbenzene	0.40
[illegible]	0.37	1,3-Dimethyl-5-ethylbenzene	0.61
[illegible]	0.38	1-Methyl-2-i-propylbenzene	0.29
[illegible]	0.23	1,4-Dimethyl-2-ethylbenzene	0.70
[illegible]	0.26	1,2-Dimethyl-4-ethylbenzene	0.77
[illegible]	0.25	n-Undecane	2.32
[illegible]	1.33	1,2,3,4-Tetramethylbenzene	0.75
[illegible]	0.71	Naphthalene	0.50
[illegible]	2.70	2-Methylundecane	0.64
[illegible]	0.92	n-Dodecane	2.00
[illegible]	0.42	2,6-Dimethylundecane	0.71
[illegible]	3.04	Unidentified	0.68
[illegible]	0.27	2-Methylnaphthalene	0.56
[illegible]	0.39	1-Methylnaphthalene	0.78
[illegible]	0.43	n-Tridecane	1.32
[illegible]	3.08	2,6-Dimethylnaphthalene	0.25
[illegible]	0.99	n-Tetradecane	0.73
[illegible]	0.48		
[illegible]	0.52		
[illegible]	0.90		
[illegible]	0.37		
[illegible]	0.96		

Source: SRI International, October 1981, Analysis and Environmental Fate of Air Force Distillate and High Density Fuels

A 1982 LIST OF HAZARDOUS MATERIALS ON REESE AFB

PART II (Cont.)
Entity Name Reese Air Force Base

Inspection Date March 8, 1983
TDWR Registration # 63005

h) List the type and estimated quantity of each hazardous waste and/or mixture of hazardous wastes generated (335.68), and indicate estimated quantity of each such waste accumulated on day of inspection [335.72(b)]:

WASTE GENERATION				WASTE STORAGE					
				Utilized Containers					
Haz WC & Code	Substance Name	DOT ID#	Qty/Mo Generated (Indicate Units)	Type	Size	Tot. #	Dat Spac.#	Total Accum. (Units)	REMARKS
	2,4-D		38 kg						Reused on Base
	[illegible]		0.5 kg						Reused on Base
	[illegible]								Recycled off Base via DPDO
	[illegible]		400 kg						Recycled off Base via DPDO
	[illegible]		300 kg						
	[illegible]								Recycled off Base via DPDO
	[illegible]		700 kg						
	[illegible]								Recycled off Base via DPDO
	[illegible]		450 kg						Recycled off Base via DPDO
	[illegible]		2 kg						Disposed off Base via DPDO
	[illegible]		34 kg						
[illegible]	[illegible]								Disposed off Base via DPDO
[illegible]	[illegible]		664 kg	Drum	55 Gal	17	172	[illegible]	[illegible]
	[illegible]		1122 kg						Recycled off Base via DPDO
	[illegible]		3.8 kg						Recycled off Base via DPDO
	[illegible]		1.1 kg						

Notes: a. Identify any accumulation of waste by (*) when storage exceeds 90 day allowable short-term storage [335.70(b)(1)]
b. In Remarks column, identify any storage container or tank that is in unsatisfactory physical condition or that exhibits other discrepancies, i.e., damage, leakage, accumulation start date missing, marking, labeling, etc. [335.72(c)].
c. In Remarks column, identify any wastes that are reused, recycled, or reclaimed.

(HWGR.33) 4/27/82)

HAZARDOUS WASTES GENERATED AND DISPOSITION:

GENERATOR	LOCATION (FACILITY #)	HAZARDOUS MATERIAL	HAZARDOUS COMPONENT	QUANTITY/MO (lbs/GL (Kg))	DISPOSITION
CE	2003	Herbicide	2,4,D	10GL (34)	(1)*
CE	2003	Rodenticide	Warfarin	1.1 lb (o.5)	(1)*
CE	2003	Bird Poison	Avitrol	.22 lb (o.1)	(1)*
MA, SS, DE LGT, SVE	50, 503, 552 366, 450, 52	Used Motor Oil	Lead, Cadmium, Chromium	265 GL (900)	(2)*
MA	40, 45, 50, 52, 70	Used Synthetic Oil	Cadmium	108GL (365)	(2)*
MA	45, 70, 88, 70, 50, 52, 930	Used Hydraulic Fluid	Cadmium	276 GL (940)	(2)*
MA, DE	52, 53, 89, 552, 70	Used Solvent (PD-680)	Lead, Cadmium, Chromium	207 GL (700)	(2)*
MA	52	Turbine Oil	Barium	1.5 GL (5)	(2)*
MA	59, 102	MEK (Solvent)	MEK	100 GL (340)	(3)
MA	59, 102	Lacquer Thinner Xylene	MIBK, Toulene,	10 GL (34)	(3)
MA	102	Paint Remover (PR-3400)	Methylene Chloride	208 GL (709)	(4)*
MA	53	Paint Remover	Orthodichlorobenzene	67 GL (338)	(3)
MA, SG	89, 1300	Photo Film	Silver	7.7 lb (3.5)	(2)*
SG	1300	Mercury Amalgam	Mercury	2.4 lb (1.1)	(2)*
RM	366	Batteries	Acid	.35 GL (1.2)	(5)*
RM	777	Lab. chemicals	Acid	.05 GL (0.2)	(4)*
MA	52	Batteries	Acid	6 GL (20)	(4)*
MA	52	Batteries	Cadmium	25 lb (11.4)	(2)*
MA	59	Electroplating Bath	Chromic Acid	315 GL per 5 years	(3)
MA	59	Electroplating Bath	Cyanide	300 GL per 5 years	(3)

Disposition Codes:
(1) Buried on-base
(2) Recycled off-base via DPDO
(3) Disposed of off-site as HW via DPDO
(4) Disposed of on-site via Industrial Wastewater System
(5) Recycled by generator

*not to be included when calculating quantities of HW generated.

APPENDIX G

Glossary

(Including acronyms and abbreviations used in the text)

GLOSSARY

List of Acronyms, Abbreviations, and Symbols Used in the Text

ADC	Air Defense Command
AFB	Air Force Base
AFCC	Air Force Communications Command
AFESC	Air Force Engineering and Services Center
AG	Above ground
AGE	Aerospace Ground Equipment
AVGAS	Aviation Gasoline
BG	Below ground
CAMS	Consolidated Aircraft Maintenance Squadron
CE	Civil Engineering
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COD	Chemical Oxygen Demand
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DoD	Department of Defense
DPDO	Defense Property Disposal Office
EPA	Environmental Protection Agency
°F	Degrees Fahrenheit
gal/yr	Gallons per year
GC/MS	Gas Chromatography/Mass Spectrometry
HARM	Hazard Assessment Rating Methodology
IRP	Installation Restoration Program
JP-4	Jet fuel used by Air Force
MEK	Methyl Ethyl Ketone
MIBK	Methyl Isobutyl Ketone
MOGAS	Motor Gasoline
NDI	Non-Destructive Inspection
No.	Number
PAH	Polynuclear Aromatic Hydrocarbon

PCBs	Polychlorinated Biphenyls
POL	Petroleum, Oil, and Lubricants
ppm	Parts per million
RAFB	Reese Air Force Base
RCRA	Resource Conservation and Recovery Act
R&R	Repair and Reclamation
TCE	Trichloroethylene
TFW	Tactical Fighter Wing
USAF	United States Air Force
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

AQUIFER - A geologic formation, or group of formations, that contains sufficient saturated permeable material to conduct ground water to yield economically significant quantities of ground water to wells and springs.

DISCHARGE - The process involved in the draining or seepage of fluid out of a lake, pipe, ground-water aquifer or similar fluid containing structure.

FRENCH DRAIN - An underground passage for water consisting of loose stones covered with dirt.

GROUND WATER - All subsurface water, especially that part that is in the zone of saturation.

HAZARDOUS WASTE - A solid waste which because of its quantity, concentration, or physical, chemical or infectious characteristics may --

(A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible, illness; or

(B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed.

LEACHATE - A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water.

LEACHING - The process by which soluble materials in the soil, such as nutrients, pesticide chemicals or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

LINER - A continuous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents or leachate.

MAGNESOL - Trademark for a synthetic adsorptive magnesium silicate used for solvent purification, clarification, and recovery.

METHYL ETHYL KETONE - An organic chemical used as a solvent in cements and adhesives.

METHYL ISOBUTYL KETONE - An organic chemical used as a solvent in paints, varnishes, and lacquers.

MIGRATION (Contaminant) - The movement of contaminants through pathways (ground water, surface water, soil, and air).

NET PRECIPITATION - Mean annual precipitation minus mean annual evapotranspiration.

OIL/WATER SEPARATOR - A man-made facility designed to separate by gravity liquids of differing densities; typically to skim oil or grease from a water surface.

PCB (Polychlorinated Biphenyl) - A chemically and thermally stable toxic organic compound that, when introduced into the environment, persists for long periods of time, is not readily biodegradable, and is biologically accumulative.

PD-680 - A petroleum distillate used as a safety cleaning solvent. Two types of PD-680 solvent have been used; Type I, having a flashpoint of 100°F, and Type II, having a flashpoint of 140°F.

PERCHED GROUND WATER - Unconfined ground water separated from an underlying regional ground-water table.

PERMEABILITY - The capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.

PLAYA - A dry, vegetation-free, flat area at the lowest part of an undrained basin, underlain by stratified clay, silt, or sand and commonly by soluble salts.

PLAYA LAKE - A shallow, intermittent lake, covering or occupying a playa in the wet season.

POLYNUCLEAR AROMATIC HYDROCARBON - A molecule consisting of two or more adjoining hydrocarbon ring molecules.

1,2-PROPANEDIOL (1,2-Propylene glycol) - A stable, colorless, viscous, hygroscopic liquid that is miscible with water, alcohol, and many organic solvents. It is used in organic synthesis and as a solvent and preservative in foods.

1,3-PROPANEDIOL (1,3-propylene glycol) - A colorless, odorless, combustible liquid of low toxicity. Soluble in water, alcohol, and ether, it is used as an intermediate, primarily for polyesters.

RECHARGE - The process involved in the addition or replenishment of water to a ground-water aquifer by natural or artificial processes.

SURFACE WATER - All water exposed at the ground surface; including streams, rivers, ponds, and lakes.

WATER TABLE - The upper limit of the portion of the ground wholly saturated with water.

APPENDIX H

HARM Form for Rated Sites,
Reese AFB

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Site D-5, Landfill

LOCATION Reese AFB, west side of savage lake

DATE OF OPERATION OR OCCURRENCE 1950's-1960's

OWNER/OPERATOR Reese AFB

COMMENTS/DESCRIPTION Local areas of subsidence reported

SITE RATED BY D. Richmann

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	114	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 63.3

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) M

Factor Subscore A (from 20 to 100 based on factor score matrix) 30

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

30 x 1 = 30

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

30 x 1 = 30

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			72	108

Subscore (100 X factor score subtotal/maximum score subtotal) 66.7

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			22	114

Subscore (100 x factor score subtotal/maximum score subtotal) 19.3

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 66.7

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors 63.3
Waste Characteristics [illegible]
Pathways [illegible]

Total 160 divided by 3 = 53.3
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

[illegible] 53.3 x 1.0 = 53.3

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Site No. FT-1, Active Fire Training Area

LOCATION Reese AFB, approx. 600' E of Bldg. 3170

DATE OF OPERATION OR OCCURRENCE -- to current

OWNER/OPERATOR Reese AFB

COMMENTS/DESCRIPTION

SITE RATED BY D. Richmann/F. Blood

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	1	3	3	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	(3)	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			80	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 44.4

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) M

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

80 X 0.9 = 72

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

72 X 1 = 72

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	1	8	8	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
Subtotals			50	108

Subscore (100 X factor score subtotal/maximum score subtotal) 46.3

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			22	114

Subscore (100 x factor score subtotal/maximum score subtotal) 19.3

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 46.3

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	44.4
Waste Characteristics	72
Pathways	46.3
Total 162.7 divided by 3 =	54.2
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

54.2 X 1.0 = 54.2

$\boxed{54.2}$

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE: Site No. D-11 Northwest Landfill

LOCATION: Northwest corner of Reese AFB

DATE OF OPERATION OR OCCURRENCE: early 1970's

OWNER/OPERATOR: Reese AFB

COMMENTS/DESCRIPTION:

SITE RATED BY: F. Blood

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	1	3	3	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			80	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 44.4

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 50

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

50 x 1.0 = 50

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

50 x 1.0 = 50

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	0	8	0	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
Subtotals			42	108

Subscore (100 X factor score subtotal/maximum score subtotal) 38.9

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			22	114

Subscore (100 x factor score subtotal/maximum score subtotal) 19.3

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 38.9

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	44.4
Waste Characteristics	50
Pathways	38.9
Total 133.3 divided by 3 =	44.4
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

B-3 44.4 X 1.0 = **44.4**

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE: Site D-4 Landfill

LOCATION: North of Sewage Playa

DATE OF OPERATION OR OCCURRENCE:

OWNER/OPERATOR: Reese AFB

COMMENTS/DESCRIPTION:

SITE RATED BY: F. Blood

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			110	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 61

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

80 x 1.0 = 80

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

80 x 1.0 = 80

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			72	108

Subscore (100 X factor score subtotal/maximum score subtotal) 66.7

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			22	114

Subscore (100 x factor score subtotal/maximum score subtotal) 19.3

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 66.7

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	57.7
Waste Characteristics	80
Pathways	66.7
Total 204.4 divided by 3 =	68.1 Gross Total Score

B. Apply factor for waste containment from waste management practices.

Gross Total Score X Waste Management Practices Factor = Final Score

68.1 x 1.0 = 68.1

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE: Site D-15 CE Paint Shop Trench

LOCATION: Behind Bldg. 553

DATE OF OPERATION OR OCCURRENCE:

OWNER/OPERATOR: Reese AFB

COMMENTS/DESCRIPTION:

SITE RATED BY: F. Blood

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			98	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 54.4

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) M

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
Subtotals			58	108

Subscore (100 x factor score subtotal/maximum score subtotal) 53.7

2. Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			14	114

Subscore (100 x factor score subtotal/maximum score subtotal) 12.3

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 53.7

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	54.4
Waste Characteristics	60
Pathways	53.7
Total 168.1 divided by 3 =	56.0
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

56.0 x 1.0 = 56.0

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Site SI-1 Industrial Waste Lake

LOCATION South east edge of base

DATE OF OPERATION OR OCCURRENCE ( )-current

OWNER/OPERATOR Reese AFB

COMMENTS/DESCRIPTION

SITE RATED BY D. Richmann/F. Blood

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			104	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 57.8

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

100 x 1.0 = 100

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

1.0 x 100 = 100

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 80

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			72	108

Subscore (100 X factor score subtotal/maximum score subtotal) 66.7

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			14	114

Subscore (100 x factor score subtotal/maximum score subtotal) 12.3

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 80

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	57.8
Waste Characteristics	100
Pathways	80

Total 237.8 divided by 3 = 79.3 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

79.3 x 0.95 = 75.3

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Site SP-1 Aqua System Fuel Spill

LOCATION POL Yard, South of Building 50

DATE OF OPERATION OR OCCURRENCE late 1940's

OWNER/OPERATOR Reese AFB

COMMENTS/DESCRIPTION

SITE RATED BY F. Blood

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	98	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 54.4

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) M

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 100

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		

Subtotals ______ ______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding		1		

Subscore (100 x factor score/3) ______

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		

Subtotals ______ ______

Subscore (100 x factor score subtotal/maximum score subtotal) ______

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 100

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	54.4
Waste Characteristics	[illegible]
Pathways	[illegible]

Total 214.4 divided by 3 = 71.5 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

[illegible] x [illegible] = 67.9

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Site D-1 Southwest Landfill

LOCATION SW edge of base

DATE OF OPERATION OR OCCURRENCE to present

OWNER/OPERATOR Reese AFB

COMMENTS/DESCRIPTION

SITE RATED BY F. Blood

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	87	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 48.3

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

80 x 1.0 = 80

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

80 x 1.0 = 80

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore -

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	1	8	8	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			56	108

Subscore (100 X factor score subtotal/maximum score subtotal) 51.8

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			14	114

Subscore (100 x factor score subtotal/maximum score subtotal) 12.2

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 51.8

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	48.3
Waste Characteristics	80
Pathways	51.8

Total 180.1 divided by 3 = 60.0 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

60.0 x 1.0 = $\boxed{60.0}$

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Site FT-7 Active Fire Training Area

LOCATION Terry County Auxilliary Field

DATE OF OPERATION OR OCCURRENCE -- to current

OWNER/OPERATOR Reese AFB

COMMENTS/DESCRIPTION

SITE RATED BY D. Richmann/F. Blood

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			51	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 28.3

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) M

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

60 x 0.9 = 54

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

1.0 x 54 = 54

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	0	8	0	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
Subtotals			42	108

Subscore (100 X factor score subtotal/maximum score subtotal) 38.9

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			22	114

Subscore (100 x factor score subtotal/maximum score subtotal) 19.3

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 38.9

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	28.3
Waste Characteristics	[illegible]
Pathways	[illegible]

Total 121.2 divided by 3 = 40.4
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

 1.0 x 40.4 = 40.4

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE: Site SI-2 Sewage Lake

LOCATION: South end of Base

DATE OF OPERATION OR OCCURRENCE: 1941-present

OWNER/OPERATOR: Reese AFB

COMMENTS/DESCRIPTION:

SITE RATED BY: D. Richmann/F. Blood

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			110	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 61

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

1.0 x 80 = 80

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

1.0 x 80 = 80

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 80

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	1	6	6	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			72	108

Subscore (100 X factor score subtotal/maximum score subtotal) 66.7

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	1	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			14	114

Subscore (100 x factor score subtotal/maximum score subtotal) 12.3

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 80

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	57.8
Waste Characteristics	[illegible]
Pathways	[illegible]
Total [illegible] divided by 3 =	72.[illegible]
	Gross Total Score

B. [illegible]

APPENDIX I

References

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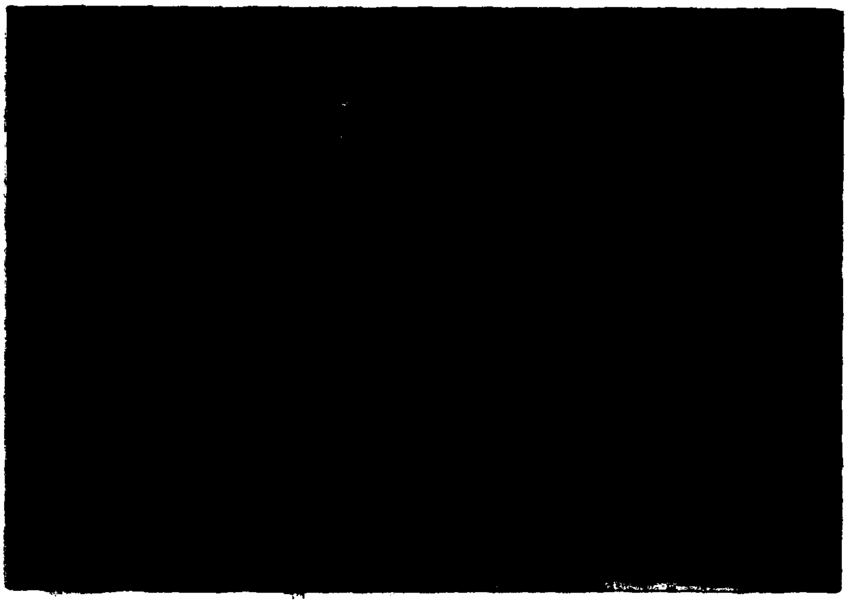
APPENDIX J

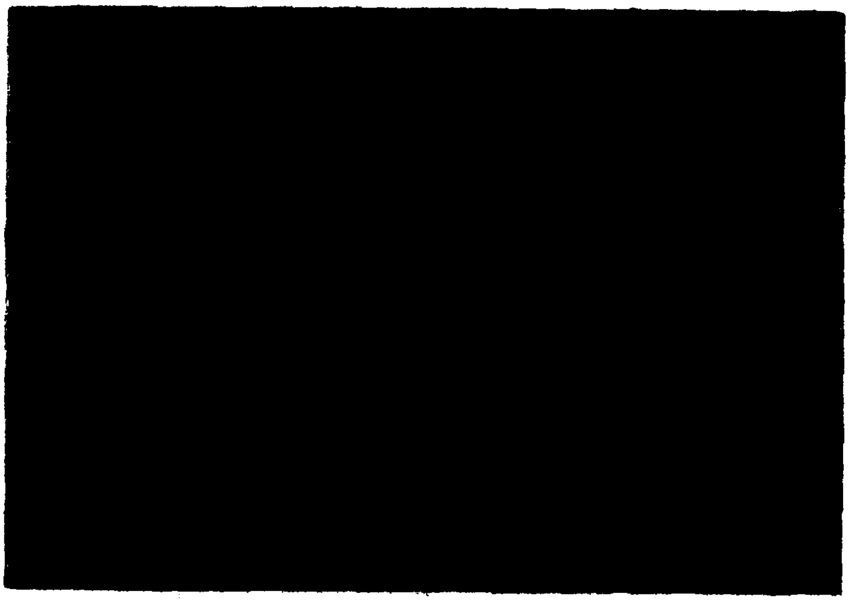
Aerial Photos

Photograph of rubble area (D-9), northeast corner of parking apron.

Photograph of FT-1, view to the southeast.



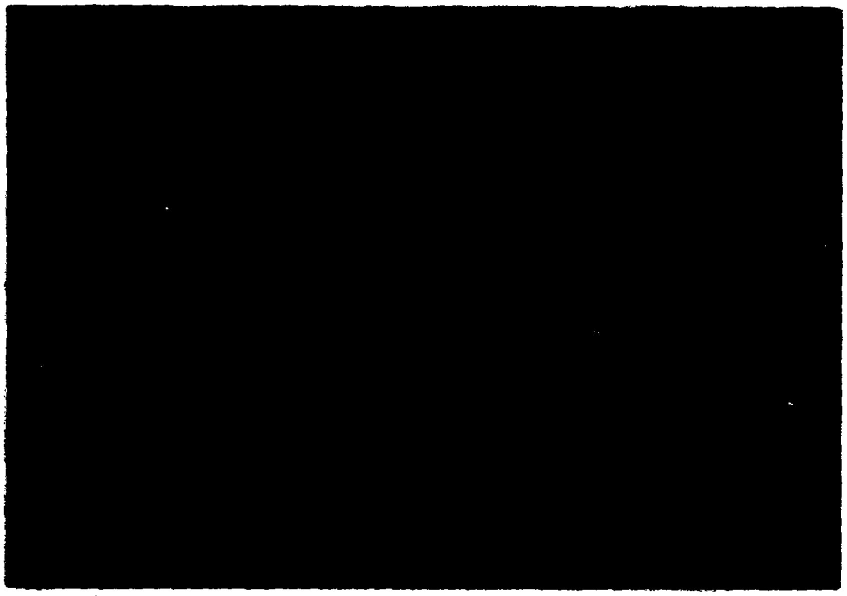
Photograph of active sludge spreading area at Sewage Lake, view to the west.



Photograph of Sewage Lake, view to the west.

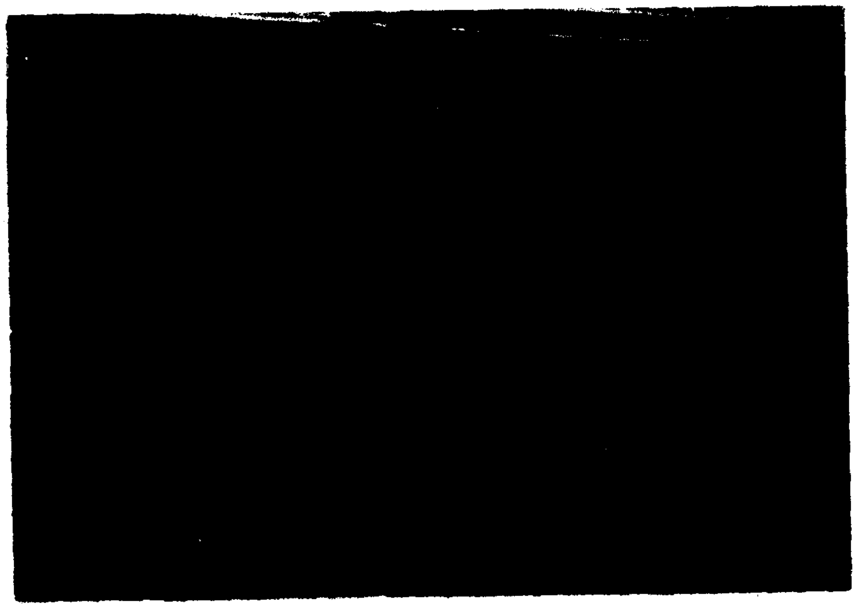
Photograph of Industrial Lake, view to the north.
Sewage Lake in foreground.

Photograph of drainage area near active fire-training area.



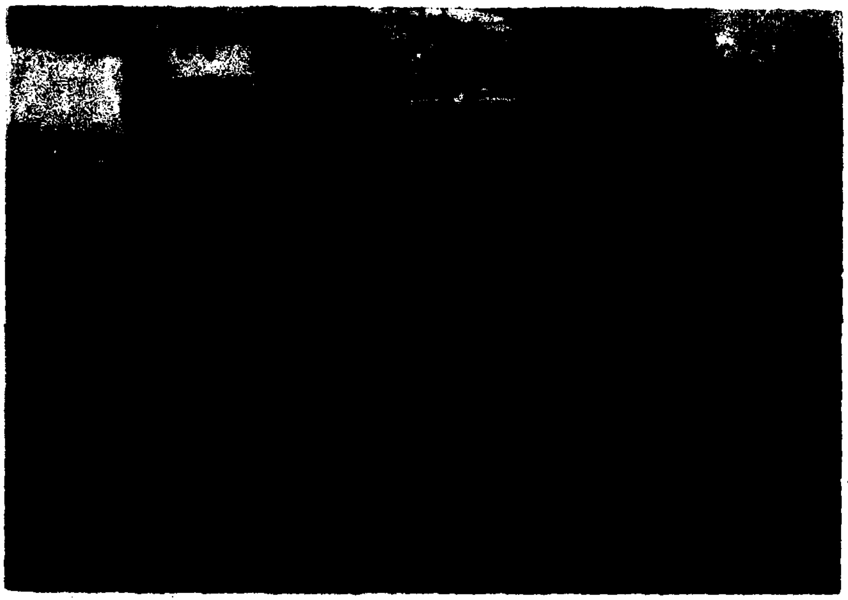
Photograph of active cell at Southwest Landfill (D-1).

Photograph of Southwest Landfill (D-1).



Photograph of Industrial Lake (SI-1).

Photograph of storage tanks, view to the west.



Photograph of suspected French drain,
vicinity of CE Paint Shop (SI-4).

APPENDIX K

List of Chemicals Analyzed by
EPA Methods 601, 602, 624, 625

TABLE 1-4. PRIORITY POLLUTANT ORGANICS (624/625)
(Gas Chromatography/Mass Spectroscopy)

Volatiles (624)

1V Acrolein
2V Acrylonitrile
3V Benzene
4V bis(Chloromethyl) ether
5V Bromoform
6V Carbon tetrachloride
7V Chlorobenzene
8V Chlorodibromomethane
9V Chloroethane
10V 2-Chloroethylvinyl ether
11V Chloroform
12V Dichlorobromomethane
13V Dichlorodiflouromethane
14V 1,1-Dichloroethane
15V 1,2-Dichloroethane
16V 1,1-Dichloroethylene
17V 1,2-Dichloropropane
18V 1,2-Dichloropropylene
19V Ethylbenzene
20V Methyl bromide
21V Methyl chloride
22V Methylene chloride
23V 1,1,2,2-Tetrachloroethane
24V Tetrachloroethylene
25V Toluene
26V 1,2-trans-Dichloroethylene
27V 1,1,1-Trichloroethane
28V 1,1,2-Trichloroethane
29V Trichlorothylene
30V Trichlorofluoromethane
31V Vinyl chloride

Acid Compounds (625)

1A 2-Chlorophenol
2A 2,4-Dichlorphenol
3A 2,4-Dimethylphenol
4A 4,6-Dinitro-o-cresol
5A 2,4-Dinitrophenol
6A 2-Nitrophenol
7A 4-Nitrophenol
8A p- hloro-m-cresol
9A Pentachlorophenol

Base/Neutral (625)

1B Acenaphthene
2B Acenaphthylene
3B Anthracene
4B Benzidine
5B Benzo(a)anthracene
6B Benzo(a)pyrene
7B 3,4-Benzofluoranthene
8B Benzo(ghi)perylene
9B Benzo(k)fluoranthene
10B bis(2-Chloroethoxy)methane
11B bis(2-Chloroethyl)ether
12B bis(2-Chloroisopropyl)ether
13B bis(2-Ethylhexyl)phthalate
14B 4-Bromophenyl phenyl ether
15B Butylbenzyl phthalate
16B 2-Chloronaphthalene
17B 4-Chlorophenyl phenyl ether
18B Chrysene
19B Dibenzo(a,h)anthracene
20B 1,2-Dichlorobenzene
21B 1,3-Dichlorobenzene
22B 1,4-Dichlorobenzene
23B 3,3'-Dichlorobenzidine
24B Diethylphthalate
25B Dimethyl phthalate
26B Di-n-butyl phthalate
27B 2,4-Dinitrotoluene
28B 2,6-Dinitrotoluene
29B di-n-octyl phthalate
30B 1,2-Diphenylhydrazine (as azobenzene)
31B Fluoranthene
32B Fluorene
33B Hexachlorobenzene
34B Hexachlorobutadiene
35B Hexachlorocyclopentadiene
36B Hexachloroethane
37B Indeno(1,2,3-cd)pyrene
38B Isophorone
39B Naphthalene
40B Nitrobenzene
41B N-nitrosodimethylamine
42B N-nitrosodi-n-propylamine

TABLE 1-5. VOLATILE AROMATIC COMPOUNDS (602)
(Gas Chromatography)

Benzene	1,2-Dichlorobenzene
Toluene	1,3-Dichlorobenzene
Ethyl Benzene	1,4-Dichlorobenzene

TABLE 1-6. VOLATILE HALOCARBON COMPOUNDS (601)
(Gas Chromatography)

Chloromethane	1,2-Dichloropropane
Bromomethane	trans-1,3-Dichloropropene
Vinyl Chloride	Trichloroethene
Chloroethane	Dibromochloromethane
Methylene Chloride	1,1,2-Trichloroethane
Trichlorofluoromethane	cis-1,3-Dichloropropene
1,1-Dichloroethene	2-Chloroethylvinyl Ether
1,1-Dichloroethane	Bromoform
trans-1,2-Dichloroethene	1,1,2,2-Tetrachloroethane
Chloroform	Tetrachloroethylene
1,2-Dichloroethane	Chlorobenzene
1,1,1-Trichloroethane	1,3-Dichlorobenzene
Carbon Tetrachloride	1,2-Dichlorobenzene
Bromodichloromethane	1,4-Dichlorobenzene

DATE

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